A Handbook for Artists and Art Students

Oil Colours and Mediums

By

H. C. Standage

Reeves & Sons, Limited

1892

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THE USE AND ABUSE

OF

COLOURS AND MEDIUMS

IN

OIL PAINTING.

A HANDBOOK FOR ARTISTS AND ART STUDENTS.

BY

H. C. STANDAGE,

Author of the "Artist's Manual of Pigments," "Water-Colour Pigments," &c.

REEVES & SONS, LIMITED,

Manufacturers of Artists' Colours,

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CONTENTS.

"*In the exercises of artists, oil should be the vehicle of colour*
"*employed from the first. The extended practice of water-colour*
"*painting, as a separate skill, is in every way harmful to the arts;*
"*its pleasant slightness and plausible dexterity divert the genius of*
"*the painter from its proper aims, and withdraw the attention of*
"*the public from excellence of higher claim; nor ought any man,*
"*who has the consciousness of ability for good work, to be ignorant*
"*of, or indolent in employing, the methods of making its results*
"*permanent as long as the laws of Nature allow. It is surely a*
"*severe lesson to us in this matter, that the best works of Turner*
"*could not be shown to the public for six months without being*
"*destroyed—and that his most ambitious ones for the most part*
"*perished, even before they could be shown.*"—RUSKIN.

PREFACE.

IN the first section of this little book we have endeavoured, as far as compatible with the space at disposal, to explode the prevalent fallacy that the old masters had better prepared and purer colours than are now obtainable.

Section II contains a brief but succinct description of the chemical composition of colours.

In the third section, an endeavour has been made, by critically examining the method pursued and materials made use of by several eminent artists, to point a moral to painters. The lesson this section teaches is that the materials used by the fine art painter do not permit him to carry out his own free will as to the mixtures of pigments and vehicles he wishes to unite. Permanency in the painting demands that some attention, at least, must be paid to the chemical composition of colours and mediums. As a help to guide in the selection of colours that are safe to commingle we offer an "ideal palette of permanent colours."

The "combination of colours for producing

various hues" will, the writer hopes, prove of service; they are such as can be made without fear of active chemical action being set up.

The subject matter of the next section will doubtless be appreciated by those to whom it especially appeals, the student in oil.

The subject on painting grounds is briefer than the subject demands, but space forbids greater elaboration. In the observations on the behaviour of oil paints and their mediums, the endeavour is made to awaken artists to the fact that the vehicles they use require as careful a selection as the pigments compounded therewith.

Section VIII is intended for the student in oil painting.

That the efforts of the writer to set before his readers as complete a *résumé* of the chemistry of painting in oil, in as few words as possible, will be appreciated is his sincere hope.

H. C. S.

Gravelly Hill, Birmingham,
April 30*th*, 1892.

SECTION I.

ON ANCIENT AND MODERN METHODS OF PREPARING COLOURS.

INTRODUCTORY.

Necessity for permanence in pictures.—Within recent years the question of the nature of artists' colours and vehicles has received attention from several authors, but not in the form of a handbook specially devoted to the subject included in the title of this little book.

The art student cannot be expected to include a thorough knowledge of chemistry in his course of study, yet the reasonable demand on the part of the picture buyer for permanency in pictures necessitates a certain amount of chemical knowledge on the part of the artist concerning the materials he employs.

It is this information that we propose to set forth in the following pages.

Although the matter in this book will supply much information conducive to this end, any amount of theoretical knowledge will avail the artist nothing unless he is assured that the colours which he uses are manufactured from pure pig-

ments and properly prepared to endure the vicissitudes to which a painting is subjected. At the present day these matters are so well understood by the colourmen with established reputations that the artist may feel safe on this score if he only employs the best qualities and entirely discards all pigments of a doubtful nature.

Duty of the Artist.—A painting that is intended to be a permanent monument of the artist's powers should have the best possible work and materials put into it. The painter owes this to his patron as much as to his own reputation.

With pure materials and a theoretical knowledge of their nature, properties, and uses, the painter even then is not equipped to produce a work faultless in regard to permanency. It is this missing something which these pages endeavour to supply.

Mixtures of Pigments.—The details concerning the colours recommended and what to avoid, should guide the brush and keep the painter from making false mixtures.

The blending of colours on the palette is fascinating to the artist ; so many new mixtures are revealed while thus playing with his colours that the artist cannot resist the temptation to make use of the hues he accidentally produces

totally oblivious of the fact that mixtures so made may be pernicious.

Old Masters v. Modern Artists.—It is a standing reproach to the more modern painters that their pictures do not bear the wear and tear of a few years without showing signs of internal decay, while we have pictures done by Venetian, Dutch, and Flemish painters of several centuries ago, that seem as fresh and bright to the eye as they probably were on the day they were painted.

Ancient recipes.—That brilliancy and permanency of such paintings is not due to superior pigments will be admitted by reading the following recipes extracted from an old Bolognese manuscript treatise on the making of colours :—

" *To make verdigris.*—Take very thin copper " and cut it into pieces of half an ounce or one " ounce each, arrange them in a glazed vase with " common salt, that is to say, one stratum of " copper and another of salt ; then fill the vase " with strong vinegar and cover it with lutum " sapientiæ,* put it underground in a damp, warm " place for a month, and you will have good " verdigris."

In the above mixture we have the formation of

* Lutum sapientiæ consisted of white of egg beaten to a froth and mixed with iron filings. This mixture was used as a cement for luting vessels.

chloride of copper, acetate of copper, acetate of iron, sulphur from the egg, and a variety of unknown substances.

" *To make good green*, take honey and strong
" vinegar, of each as much as you like, and in-
" corporate them very well together, then put the
" mixture into a well luted copper vase, place the
" jar a foot deep in every direction in warm dung
" in a place where the sun shines plainly, and let it
" remain so for a fortnight, then take it out and
" you will find all the matter converted into full
" verdigris of a perfect kind."

In this mixture the fermentation set up between the honey and vinegar actively reacts on the copper and acetate of copper is formed.

" *To make green.*—Take as much as you like of
" white vinegar and add to it some verdigris re-
" duced to a fine powder, a little powdered roche
" alum, a little saffron, a small quantity of the
" juice of rue, and a little powdered gum arabic ;
" let it stand over the vinegar for five days, then
" mix a little ceruse with it, and it will become of
" a fine green colour."

" *To make green*, take indigo and grind it with
" plenty of saffron and mix a little white lead and
" gum water, and it will become green."

" *To make azure.*—Take 1 oz. of sal ammoniac
" and 6 ozs. of verdigris and grind these powders

" very fine with oil of tartar upon a marble, then
" put them into a glazed vase and let them stand
" some days, and you will find the verdigris con-
" verted into a very beautiful azure."

Many more similar crude recipes could be quoted showing how little was known about chemical science, but these are sufficient to demonstrate that the colours used by the brilliant colourists of the sixteenth century were certainly not equal in any respect (brilliancy of hue perhaps excepted) to those obtainable at the present day.

A primitive mode of producing a golden yellow.—The following extract shows so very forcibly to what expedients the colourmakers resorted for the production of pigments, that we are tempted to give it.

" *To make a good and fine gold colour.*—Take a
" hen's egg, make a small hole in it, take out the
" white and leave the yolk in the shell, then fill it
" with quicksilver and stop up the hole securely and
" put it under a sitting hen for the space of thirty
" natural days, and you will have a golden colour,
" which you must distemper with gum water."

The *rationale* of this process for obtaining a "golden yellow," is that sulphuretted hydrogen gas is generated during the decomposition of the yolk of the egg and the mercury forms a sulphide of mercury of a yellow tone.

When we contrast a few modern methods of making pigments with those quoted, artists will see at once that they are no longer justified in speaking of the superiority of the colours used by the old masters.

Dutch process for making Vermilion.—The old Dutch method of making vermilion, or cinnabar, was as follows: a mixture of mercury and sulphur was made by gradually adding 170 lbs. of metallic mercury to 50 lbs. of melted sulphur, the latter body is cast into an iron pot and the materials are stirred up with an iron spatula, but not so rapidly as to give rise to active combustion. After the above proportion of ingredients are thoroughly mixed it is poured out on to iron plates and broken into pieces; after cooling, the fragments are then put into hand-jars capable of holding one and a half pints of water, previous to sublimation. The vessels in which the compound is sublimed are of earthenware, cylindrical, 4 feet high, glazed within and closed at the bottom; these vessels are sunk two-thirds of their depth in a furnace, in which their lower part is heated to redness. A few hand-jars full of the mixture are thrown into each of the subliming vessels and the contents left to crackle and burn until the greater part of the excess of sulphur volatilises and the flame diminishes. The smooth level tops of the jars are then covered with

flat plates of cast iron; as soon as a sufficient quantity of cinnabar has collected on these plates they are removed and others substituted, the cinnabar which has collected on the upper parts of the vessels being first put back. That which has been collected on the plates is detached and ground as finely as possible with rain water.

Chinese process for Vermilion.—In the Chinese method of making vermilion, one part of sulphur and four parts of mercury are sublimed in an earthen vessel to which an iron cover, kept constantly moist, is luted; the fire is kept up for a day and a night, when the vessel is taken away, allowed to cool, and the compound broken up. The sublimate is then separated into two qualities, the purest and impure vermilion, the latter is re-sublimed and the powder is sifted into a large vessel filled with water, which with the scum floating on it is poured off after awhile; the process is twice repeated, and lastly the sediment at the bottom is dried. The Chinese vermilion, which is about six times as dear as the European variety, possesses a carmine cast, whereas that prepared by the European methods incline to a yellow tinge. Although the Chinese samples exhibit no foreign matter except a little glue, the chief point to be attended to in the production of vermilion is that no black amorphous sulphide of mercury should

become mixed with it. There are several other methods of producing this beautiful red pigment, but the above examples are sufficient to show the great care and attention bestowed in every detail in the fabrication of modern pigments. To emphasize these facts we give the general details of the manufacture of artificial ultramarine—the two substances—native and artificial—being identical in chemical constitution.

A modern method of making artificial Ultramarine.—Gmelin's method of manufacture is as follows:—Soda-lye saturated with precipitated silica is mixed with aluminium hydrate (containing 20 per cent. of water and obtained by precipitation from alum not containing iron) in such proportion that the mixture shall contain 31 parts of dry silica and 26 parts of dry alumina; the liquid is then evaporated to dryness, and the pulverised residue is mixed with flowers of sulphur. In the next place, the same quantity of a mixture of dry sodium sulphate and flowers of sulphur in equal parts by weight is added and, after being carefully mixed, the whole is stamped into a crucible so as to completely fill it. The crucible tightly closed is quickly heated to redness, so that the sulphur may not volatilise before the sulphide of sodium can be formed, and the mass is kept at a red heat for two hours. The crucible is then left to cool with the cover on and

the greenish-yellow product (green ultramarine) is gently heated in a porous crucible in which narrow channels have been bored to increase the draught. The blue mass thus obtained is finely pulverised, levigated and washed.

This process includes all the conditions essential to the production of a good ultramarine. There are various other methods of making this beautiful blue pigment, but all of them depend upon extreme care in the manipulation in order to produce a fine blue tone.

Adulterated Pigments.—Artists' colourmen are often blamed for selling adulterated pigments: the remedy lies with the artists themselves. But even on that point, present day pigments cannot be condemned in favour of those of the old masters' days. Cennino Cennini advises the painter to purchase cinnabar "unbroken and "unground; the reason for this is because it is "often adulterated with minium (red lead), and "with pounded brick dust." It should be understood that this caution is not directed against colourmen—that trade is a comparatively modern invention—but such colours as the artist could not well prepare himself, of which vermilion is one, he was directed to purchase from the apothecary; it was this worthy who did not scruple to increase his profit by adulterating his goods.

The superior permanence of ancient paintings compared with modern.—Thus far the superiority of make and freedom from adulteration of fair-priced colours should increase the permanence of modern paintings. The fact is, however, quite the other way, and we are forced to the conclusion that the greater permanence of those paintings that have survived the ravages of centuries is due to the care and skill of the painter in his technique.

Even attention to these points alone, however, would not suffice to guard many of these crudely made pigments from decomposition. The permanence of such dangerous pigments is undoubtedly due to the employment of a medium that partook largely of the nature of a varnish which securely locked up the pigments before their chemical activities could bring about destructive changes.

Grinding colours, ancient and modern methods.—As regards the method of preparing the colours for the palette these ancient painters were far behind our present methods. One thing of great importance to the purity of the colour was that the colour was usually well ground under water, and bringing it into as impalpable powder as possible by hand labour, but for grinding up the colour in the vehicle their only resource was a

porphyry slab and a stone muller. There is something to be said in favour of this simple means of grinding, for only a small portion of pigment could be operated upon at a time, and therefore this small quantity was more likely to be better ground than if a large quantity were attempted. The modern method of grinding pigments with the vehicle consists of passing the mixture between a series of three or five granite rollers which are made to revolve by steam power. It is in this operation that a saving in cost of manufacture can be made in a prepared colour.

Reason for cost of good colours.—Many pigments require several hours' grinding before they are brought to the consistence which gives them their best working qualities; but this long time means a heavy item for labour and power, therefore if the colour be sold cheaply the requisite number of hours in the mill cannot be afforded. Besides this, many pigments, such as the oxides of iron, "burn" the oil whilst being ground, that is, they so enter into combination with it as to alter its physical nature, and their change is greatly dependent upon the rate at which the rollers revolve. There are many other details requiring constant attention on the part of the grinder, and it is on the due performance of these details that a pigment will show itself to best advantage as an artist's colour.

Early history of Oil Painting.—It is a disputed point as to who actually invented oil painting. Walpole offers good evidence that it was practised in England long before we have proof of its existence on the Continent, where the brothers Hubert and Jan Van Eyck divide the honours with another painter who lived in the same era.

Whether the Van Eycks were really the inventors of this style of painting or not, it is certain that to them is due the honour of leading the fashion in this then new departure in painting. What, however, we call oil painting as it was practised by these and the Dutch, Flemish, and Venetian painters, is really distinct from the oil painting of the present day. What was then practised, was more approaching varnish painting, for all their vehicles were prepared more or less with a resin of some sort, usually sandarac.

Sir Joshua Reynolds was the first prominent painter who introduced this mode of painting into England. Of his numerous mixtures and formulæ for compounding colours we have abundant evidence in his biographies by Northcote and Malone. In Sir Joshua's day there was no artists' colourmen like those of to-day.

Rise of Colour Manufacturing.—It was during his lifetime, about 1768, that Thomas Reeves (the founder of the present firm of Reeves and Sons)

may be said to have inaugurated a new era in fine art colour production. In those days it was customary for the artist to keep his colours in a gallipot covered with water to prevent the colours drying on the surface. This mode of storing the colours was improved upon afterwards by keeping them in skins, the colours being squeezed through a hole pricked in the side. It was only within more recent years that the well-known, convenient, and cleanly collapsible tube was invented. From this time downwards, improvements of various kinds have been introduced.

Having touched upon a few points in connection with the art of painting in oils from its origin until the present day, we will now enter more fully into the composition and characteristics of the prepared pigments used by artists.

SECTION II.

ON THE CHEMICAL COMPOSITION, PHYSICAL QUALITIES, AND ARTISTIC MERITS OF PIGMENTS.

Origin of Pigments.—Some pigments are found naturally as earths ; for example, the ochres, brown, red, and yellow ; the silicates, as terre verte ; and carbonates, as of copper. Other pigments are produced artificially by chemical means, for instance, sulphides of mercury (vermilion) and cadmium (yellow), the chromates of lead and barium (chrome and lemon yellows), the lakes being a combination of a vegetable or animal colouring matter with a metallic base.

Composition of Pigments.—As regards the composition of pigments, the natural earths are generally oxides of iron, chemically united with water and mixed with earthy substances, such as silica, flint, or clay, &c., while those produced artificially, being either oxides of metals, as red lead, venetian and light red, &c. ; or carbonates, as

white lead, mountain blue (carbonate of copper), or sulphides or chromates. Others, again, are obtained by extracting the colouring matter from flowers or seeds (*e.g.*, iris blue and bistre), or of insects, as carmine; and some others are procured from the animal kingdom, such as ivory and bone black.

Complexity of Composition.—From this brief summary of the nature of pigments we see that not only are they very diverse—oxides, sulphides, and carbonates, &c.—in their composition, but also very complex, since some consist simply of oxygen united with the metallic base, and others are a mixture of oxygen, sulphur, silica, potassium, &c., while some are extracts of vegetable products and insects.

WHITE PIGMENTS.

Flake White.—The most extensively used white pigment in oils is a mixture of carbonate and hydrate of lead, commonly known by the above name. It takes this name because in the process of manufacture the white pigment falls in flakes from the corroded metallic lead. This white is very solid and dense, or opaque, which gives it

more covering power than any other white oil pigment. The extent to which this white is used by painters in oils almost precludes the hope that it will ever be dispensed with. Artists like it because it is so unctuous and nice to use, but it has many serious drawbacks that should condemn it for all fine and important works.

These drawbacks are, firstly, the tendency that it has to become yellow and brown with age, and on exposure to gases containing sulphur ; secondly, is its gradual loss of opacity, that is, if flake white were solidly painted over a dark ground, the white will in time become less opaque or semi-transparent enough to allow this dark ground to appear through.

As this white is so frequently used in all kinds of painting, particularly for flesh or figure painting it is not necessary to excuse a somewhat scientific explanation of the chemical reactions producing the above change.

Flake white, or white lead, as it is commonly known to house painters, is a mixture of carbonate of lead and hydrate of lead ; chemically the formula is expressed thus : $2PbCO_3$ (carbonate of lead) and PbH_2O_2 (hydrate of lead). This means that two equivalents of lead are united to two equivalents of carbon dioxide, and there is also present two additional equivalents of oxygen, or in other words one equivalent of oxide of lead is

united with one equivalent of carbon dioxide multiplied by two. The second formula represents one equivalent of oxide of lead is united to one equivalent of water, and the two formulæ taken together represent that two equivalents of oxide of lead are mechanically mixed (not chemically united) with one equivalent of hydrate of lead.

Ordinary flake white and white lead consist of this mixture of carbonate and hydrate of lead in variable proportions; this mixture is not made intentionally but in the process of converting metallic lead into white lead. Thus when this white is made by the old Dutch process, metallic lead is submitted to the fumes of acetic acid or wood vinegar, which converts the metal into acetate (*i.e.*, sugar) of lead. The fumes of acetic acid are generated from wood shavings, and as they are decomposed carbonic acid gas is also disengaged; this carbonic acid acts on the acetate of lead which is first formed, and converts it into carbonate of lead. The acetic acid that is now set free from the acetate of lead again acts on the undecomposed portion of the metal to convert it into acetate, which in its turn is also converted into carbonate of lead, and so the process proceeds until the whole of the metal is converted into the white carbonate and hydrate. Besides the conversion of the lead into acetate and the subsequent

reconversion of this into carbonate, a part is converted into hydrate. When the greater part of the metallic lead has become corroded (converted) into white lead (*i.e.*, flake white, because the corrosive form of the salt takes the appearance of flakes or thin liminæ) it is scraped off. This operation is conducted with the material steeped in water to prevent the workmen being poisoned by the particles of lead carbonate that would otherwise float in the air. It is then otherwise treated to fit it for the purpose of the painter, but no attempt is made to separate the carbonate from the hydrate of lead that has been formed simultaneously. The fact is that it would be impossible to do so by mechanical means. As a result white lead made by this means consists of an intimate mixture of about one-fourth to one-third of hydrate and three-quarters to two-thirds of carbonate of lead.

Now some authorities maintain that the mixture of hydrate and carbonate of lead is the best form of white lead for painters' purposes; but such is *not* the case, since the hydrate of lead is more readily acted upon by foul gases than carbonate of lead alone. In proof of this assertion I would refer my readers to an article from my pen on the "Chemistry of the Painters' Art," that appeared in a trade journal a few years ago,* wherein I give in

* *The Plumber and Decorator*, for August, 1889.

detail the experiments I made, by which I prove that the hydrate of lead is a cause of quicker disintegration of white lead than when the white lead is pure carbonate of lead. To give in brief the cause of the disintegration of white lead ground in linseed oil, I should state that when a lead pigment—oxide, carbonate, or acetate—is added to a fixed oil, such as linseed, the mixture saponifies; in this manner, the metallic oxide combines with the fatty acids, the olein and stearin of the oil, to the exclusion of their base, glycerin, setting it free; the union of the lead salt with these acids produces a kind of soap or "linoleate" of lead.

Now hydrate of lead much more readily saponifies because the elements of water are more easily eliminated, and the lead and hydrate that remains combine very quickly with the fatty acids in the linseed oil. The glycerin set free from the oil and the equivalent of water (hydrogen and oxygen) eliminated from the lead hydrate that is formed is still more soluble in water than it would be were this glycerin not set free. Now with the pure carbonate of lead, this soluble linoleate of lead is not so readily formed, because the carbonic dioxide (CO_2) present does not so easily forsake the plumbic oxide (PbO) to which it is chemically united, and as a consequence the linseed oil, by imbibing oxygen from the air, becomes quickly

converted into tough impermeable *linoxide* of lead. But in the case of a mixture of carbonate and linoleate of lead the proportion of linoleate of lead formed increases in proportion to the hydrate of lead present in the white lead—thus—

$PbOH_2O$	and fatty acids	=	H_2O and linoleate of lead.
Hydrate of lead.	Oleic and Stearic acids.		Water.

A somewhat analogous reaction takes place between the hydrate of lead and sulphur fumes, the elements of water in the hydrate quickly forsake the lead oxide (PbO), sulphur having a greater affinity for the lead than the water has.

Thus—

$PbOH_2O$	and H_2S	=	PbS	and $2H_2O$
Hydrate of lead.	Sulphuretted hydrogen.		Sulphide of lead (black or brown).	Water.

The hydrate of lead becomes browner or blacker than the pure carbonate of lead or mixture of the two, under the action of sulphuretted hydrogen, because a larger proportion of lead is seized upon by the sulphur and converted into black sulphide of lead. It is for this reason that the white lead containing most carbonate does not turn so dark on exposure to foul gases, for there is a large proportion of white carbonate unacted upon by the sulphur.

There are many other chemical changes that occur in the mixture of white lead with other pigments, these, however, the limits of this book do not permit us to discuss. In such reactions the carbonate of lead plays a part quite as important as the elements of water do in the hydrate, as the carbonic acid has under certain circumstances less affinity for the lead oxide with which it is combined than the other elements that produce the chemical reactions in the mixture.

Kremnitz White is a similar pigment to the above, but inferior to it in body although superior in whiteness. It takes its name from Kremnitz in Hungary, where it is manufactured.

Dutch White contains 25 per cent. of white lead and 75 per cent. of barium sulphate.

Hamburg White is a mixture of two-thirds barium sulphate and one-third white lead.

Venetian White is compounded of equal parts of barium sulphate and *carbonate of lead*, as white lead destroys the tints formed by it with the lakes (madder lakes excepted), probably by oxygenating them and so bleaching their colours.

Foundation White is essentially an oil colour, it is compounded for the most part of flake white and zinc white. It dries quickly, and is used for priming the canvas or painting ground previous to painting on it.

New White is a mixture of zinc white and Kremnitz white ; all these mixtures of lead and zinc whites are more permanent than the lead whites alone.

Silver White, French White or Blanc d'Argent is a carbonate of lead produced by precipitation, it has less body than flake white, but is otherwise similar to it in characteristics.

Zinc White is oxide of zinc ; it is slightly bluish, and somewhat destitute of body compared with flake white. It is rather slow to dry, but is perfectly permanent under all conditions.

Chinese White is also another white obtained from zinc, but is only useful in water colour.

Permanent White, or Baryta White, is precipitated sulphate of barium. It is perfectly innocuous, but it has no body in oil and therefore only suited for water-colour, but even then it is objectionable, since when wet it is denser than when dry.

Permanent Flake White is Messrs. Freeman's "non-poisonous white lead," introduced to artists under the above name. It is essentially sulphate of lead which is unaffected in mixtures, &c. It is prepared by a special process in conjunction with oxide of zinc which gives it great body, although sulphate of lead by itself has no body.

RED PIGMENTS.

In the reds there are a great variety of hues, some of the most brilliant and transparent of colours, as the madder lakes, and some of the most sombre, as light red, whilst the brightest, vermilion, stands unrivalled.

Vermilion.—This pigment is one of the ancient colours, it was known in very early times as *cinnabar*, and is pure sulphide of mercury. Sulphide of mercury is of two kinds, the black, amorphous variety, known in pharmacy as *æthiops mineralis*, and the crystalline variety which we know as *vermilion*. This name is generally given to the factitious or artificial variety, whereas the native red pigment is commonly called *cinnabar*. Messrs. Russell and Abney have established the fact that the modern vermilion (in water-colour) darkens and even blackens on exposure in air to sunlight, &c., but we have examples of paintings in the National Gallery, which were painted some hundreds of years ago, wherein the vermilion is as bright as any freshly ground modern pigment. The cause of this is perhaps due to the use of native cinnabar by the old painters.

The artificial vermilions are usually produced by sublimation known as the *dry* way, although much of this pigment is produced by precipitation or the

wet way ; the former method, however, produces the most permanent colour. The vermilion made in China, or by the Chinese method, is usually the best in all respects, its hue being more of a crimson, whereas the European made vermilion has a tinge of orange; these variations afford several well marked tones of this colour.

This pigment is useful in oil, water, or fresco, but since it is volatile at a fierce heat it is inadmissible in enamel. It has great body, opacity, and weight, the latter quality renders it very liable to sink away from the vehicle incorporated with it. It dries somewhat slowly. In brilliancy of colour vermilion is equalled only by the fugitive iodide of mercury, &c., "pure scarlet."

Extract of Vermilion and Scarlet Vermilion are synonymous terms for a vermilion possessing a scarlet hue, but

Orange Vermilion inclines to a bright red orange.

Field's Orange Vermilion is not so opaque as the last mentioned and is purer in tone.

On Vermilions in General.—In water-colour the vermilions are liable to wash up, but in oils they cannot do this, and therefore are serviceable in scumbling and for being glazed over with lakes in the production of rich crimson draperies, &c. Vermilion with whites gives very charming flesh

carnations. Chinese vermilion will be found the safest for use. In glazing of the lakes the madders only should be used, as the cochineal lakes over this pigment are changed in hue.

Pure Scarlet, or iodide of mercury, is so fugitive that ordinary candle light will cause it to alter its hue. It is therefore useless to the artist.

Light Red is an ochre, *i.e.*, oxide of iron on an earthy base of silica and alumina. It is of an orange-russet red and perfectly permanent, useful in landscape painting and in mixtures. Being an oxide of iron it dries well in oil. It is prepared artificially by calcining yellow ochre.

Venetian Red is also an oxide of iron but of a brighter red hue than the above. It is usually prepared artificially for commercial use by fusing ferrous sulphate and plaster of Paris together, but the finest hues are produced without an admixture of lime salts. It is permanent, of good body and drying power, and is useful in tints, and with blues to form greys.

Indian Red is another oxide of iron, but of a purplish-red tone ; this tone is due to the presence of a lower oxide of iron combined mechanically with the sesqui-oxide of iron, which is of a brighter red hue. This pigment is permanent in oils, but it has been found in mixtures with the vegetable indigo blue to stand alone after some time, the blue

having disappeared. This may be accounted for in two ways; either by the action of light and air on the indigo, causing it to be converted into the white variety of indigo, or even by the tendency of the lower (purple) oxide of iron, present in the Indian red, to absorb oxygen, indirectly bringing about the oxidation of the indigo, when the same white product is the result, and as a consequence only the red hue of the iron pigment remains visible of the mixture.

Mars Red is an artificial iron ochre more chemically active than the native ochres.

Red Ochre is a very ancient pigment; it is a native red earth, and possesses a more ochreous or sombre hue than light red.

Red Chrome is a basic chromate of lead, and being particularly rich in the metal, it is not permanent under the action of sulphurous fumes or deoxidizing agents.

The Cochineal Lakes are the product from precipitating the colouring matter inherent in the *coccus cacti* insect on a base of clay or alumina.

Experiments have proved these colours to be fugitive in water and oil. Sir J. Reynolds' paintings sufficiently confirm their want of durability in oil.

Carmine is the most permanent of the cochineal lakes. It is a colour of wonderful richness and brilliancy.

Crimson Lake is a similar colour, with a slight inclination to violet in tint.

Scarlet Lake is crimson lake and vermilion ; it is less permanent than the other two.

These two colours have hitherto been used in oil for glazing, they are pleasant to use, they will not stand the action of light, and are not permanent in combination with white lead.

Permanent Crimson.—This is a colour of recent introduction ; it is a preparation of alizarin, and partakes of the nature of the cochineal lakes in point of hue, but differs from them in its character of permanency. It is impervious to the action of light and other agencies, and may be used in mixtures. This colour is considered to be one of the greatest acquisitions to the modern painter's palette.

The Madder Lakes are the most permanent of the rich red lakes. These pigments are obtained by precipitating colouring matter extracted from the root of the *rubia tinctorum* plant on an aluminium or tin base ; usually the former.

Madder Carmine is the richest of the lakes, and is the only durable carmine (comparatively) on the palette of the aquarellist or painter in oils. It gives splendid washes.

Rose Madder is not so intense as the above, and washes, if anything, better ; it gives the most perfect carnation tints.

Pink Madder and Madder Lake are other names for varieties of the above lakes.

All the madder lakes dry slowly in oil; it is probable that the aluminium base does not take kindly to the oil.

Indian Lake is obtained from a resinous secretion found in certain plants in India. It is a deep, transparent, rich lake, but unfortunately is not permanent for any length of time.

BROWNS AND OCHRES.

Yellow Ochre is the first, because it is so permanent and extensively used. The ochres are found native, although many are artificially prepared for the artist's use. Chemically considered, the ochre is a mixture of silica, alumina, and oxide of iron; and the tones given to the ochres depend on the amount of iron oxide present. In many cases the iron is not a pure oxide (*i.e.*, a simple combination of iron and oxygen), but an iron hydrated oxide, that is, containing a certain proportion of water, and as such it is a mixture of iron, oxygen, and hydrogen. The water, however, can be expelled by heat, leaving the oxide pure. In the case of a darker red ochre, the oxide of iron is sometimes as much as 70 parts by weight in 100 of the ochre, and the water

varies from 10 to 30 parts in the 100 of ochre. Yellow ochre, to be used as an oil colour, should have the water expelled, because, as the paint dries, the oxygen in the ochre helps to harden the oil by parting with oxygen thereto in a manner which the limits of our space do not permit us to discuss; this is the reason why ochres and oxides are such good drying paints. Now if the water were not previously expelled, during this passage of oxygen to the oil, some of the contained water in the ochre would be set free, and so hinder the drying process of the oil. The experiences of painters and chemists prove that yellow ochre is permanent under all conditions. It is useful in mixtures for all kinds of painting, flesh, landscape, &c.

Native and Roman Ochres, Burnt and Brown Ochres, Transparent Golden Ochre, are only fanciful names for diverse varieties of yellow ochre, the tints and methods of production varying. They are all permanent oxides of iron.

Raw Sienna is also a pigment that owes its colour chiefly to oxide of iron, it is a native earth.

Burnt Sienna is the same pigment calcined, which process converts the hue into a reddish brown of a transparent nature.

Vandyke Brown is another brown earth of a fine, bright, brown hue.

Cassel Brown and Earths differ from it only in the differences of tint and name.

Indian Brown and Cologne Earth are also brown, earthy oxides useful in some cases.

Manganese Brown is a hydrated oxide of manganese prepared artificially. It is a rich, dark, permanent brown.

Cappah Brown is a combination of oxides of iron and manganese; it is a dark brown of the umber class with good body, and is fairly permanent.

Verona Brown is obtained by calcining the native earth—terre verte ; it consists chiefly of magnesium silicate coloured with oxide of iron. It is fairly permanent in oil colour.

Raw Umber is a compound of iron and manganese silicate, and

Burnt Umber is the same variety calcined. The first is a brown, and the latter has a ruddier tinge. Both are practically permanent in oils.

Caledonian Brown is a useful colour made by mixing two brown earths and is therefore reliable.

Bone Brown and Mummy are of organic origin. The first being produced by the calcination of bones by a particular process, so as not to char them, while the latter pigment is actually the ground-up body of a mummy, it is best avoided. Both are bad driers in oil.

Brown Madder has been proved to be impermanent by the official trials. It is a rich, reddish brown of a transparent colour and very useful, having good body and working well. The artist can, however, dispense with its use, as a similar colour can be made with a mixture of permanent crimson, burnt sienna, and a little French ultramarine.

Brown Pink and Italian Pink are pigments of an entirely different hue, being obtained from the quercus nigra (quercitron) bark. They are transparent lakes and lack permanence.

Yellow Lake is another colour of vegetable extraction possessing a slightly greenish tone. It has no permanence.

Asphaltum and Bitumen are also pigments—natural pitches—that while unchangeable as regards their hue, possess physical drawbacks, being affected by increase of temperature, so much so as to cause the colour to move on the canvas, which renders them very undesirable pigments to use. We have, in the National Gallery, examples of the use of this colour in paintings executed by Sir David Wilkie and Sir William Boxall, which should be sufficient warning against the employment of these pigments.

From the above it will be seen that the palette is rich in browns, but some of the most pleasing are of organic origin and not permanent ; these should be avoided.

YELLOWS.

Lemon Yellow is a pale yellow approaching to that of the primrose. It has a slight greenish tinge, and forms excellent greens with Prussian blue. The chromates of lead, zinc, strontium, and barium, are all sold under the name of lemon yellow, but the true pigment should be compounded of the barium salt as it is the only one really permanent.

Strontium Yellow is a chromate of strontium, it has less body and is more brilliant than lemon yellow, but inferior in permanency.

King's Yellow or Orpiment is one of the most ancient pigments. It is a sulphide of arsenic and a deadly poison, most attractive in hue but very treacherous as regards permanency. It only finds a place here as a pigment to be rigorously banished from the artist's palette.

Platinum Yellow more often than not is a compounded yellow containing no platinum whatever. It blackens on exposure.

Cadmium Yellow (Pale) is a sulphide of cadmium, and, on account of the sulphur in its composition it is not permanent in mixtures that are affected by sulphur (lead chromes, white lead, &c.). It is of rich primrose hue and good body, but not reliable in water or oil.

Cadmium Yellow (Middle) is a deeper variety—also a sulphide of this metal—of a rich yellow and more permanent than the paler tones.

Cadmium Orange (Deep) is of an orange hue of the same composition. It is of greater permanence, but not thoroughly so.

Radiant Yellow is a speciality of Messrs. Reeves and Sons. It is a cadmium sulphide free from all traces of impurity. The colour is a rich, luminous yellow, so little liable to change as to be practically permanent. The body and working qualities are excellent.

Chrome Yellow (Pale) is a chromate of lead and other lead salts of a lemon hue, with good covering power but not permanent.

Chrome Yellows, Middle and Deep, and Orange are similar gradations to the cadmium yellow ; these chromates of lead are liable to be decomposed by chemical reactions occuring in mixtures, but when locked up in an oleoresinous vehicle the writer believes they would be thoroughly permanent under all conditions. Experiments have estab-

lished the fact that these lead chromes are permanent and suffer no change when used as water-colours, if used as an oil colour they should be still more permanent, and no doubt would be, were it not for the process of saponification that takes place between the oil vehicle and the lead base. A quick drying oleoresinous medium would prevent this saponification, and so render these splendid and useful yellows permanent. They possess excellent body, work well, but are somewhat lacking in the softness of hue of the cadmium yellows.

Aureolin is a yellow of a golden hue ; it is a complex composition of the nitrites of cobalt and potassium, it may be considered permanent, and is generally useful in oils, being a very transparent pigment and safer than gamboge or Indian yellow.

Gamboge is a species of resinous matter, more useful in water than oils, and permanent in washes.

Indian Yellow is purely an organic pigment, and although a rich, transparent yellow, is not permanent.

Naples Yellows are yellows of a peculiar tone, varying in intensity. They are very useful in flesh painting, and for skies, and their body or opacity render them otherwise of great service to the artist. The true Naples yellows are composed of lead

antimoniate, but as this salt is so easily blackened by impure air, a mixture of cadmium yellow and zinc white is now almost invariably substituted. This latter combination is practically permanent.

GREENS.

There are a large number of greens, some of very beautiful tones, but for the most part they are unstable.

Emerald Green is the lightest and most brilliant, but it is not permanent in mixtures, and is too vivid for extensive use: chemically it is compounded of arsenic, copper, and acetic acid; it has very little density or covering power.

Mineral Green is also another compound of copper and arsenic, it differs in hue, however, in being a dark bluish tone. It is probably impermanent.

Malachite Green is obtained from a copper mineral—malachite—it is of a bluish green colour, liable to change on exposure to light, air, and on admixture with cadmium yellow, &c., whether used in oil or water. If very carefully prepared experience has proved it to be permanent in oil.

Verdigris is a compound of acetic acid and copper, and is still more fugitive and liable to change than those greens first mentioned.

Olive Green is a mixture of yellow and blue pigments, and hence not to be depended on.

Olive Lake is another similar mixture, and has the same defects.

Sap Green is now compounded of yellow and blue pigments, but was originally of organic origin. It is not to be depended on for permanence.

Chrome Greens are mixtures of chromate of lead and Prussian blue. The greens are of good colour, but the mixture of these two pigments is one not conducive to stability.

Cobalt Green is a compound of oxides of cobalt and zinc. In colour it ranges from a yellowish to a bluish green, the latter variety being the most permanent. It works well and is a particularly useful colour in oil.

Green Oxide of Chromium is of a sage green hue, it is practically unalterable under all conditions, being produced by the fusing of its components it will stand the fiercest heat unchanged. Possessing a good body and working well, it makes agreeable tints with white.

Veronese Green or Viridian is a brilliant hydrated oxide of chromium of an emerald hue, and very transparent, but inclining rather to blue. It is perfectly permanent and particularly commended for use, it is known in France as Vert Émeraude.

Terre Verte is a sober green earth or ochre, thoroughly permanent and very useful.

The only really permanent greens are the last three. Blue and yellow pigments form good green hues, but such mixtures cannot be depended on for remaining unchanged, since the chemical re-action that is set up engenders change sooner or later.

BLUES.

Prussian Blue, Chinese Blue, and Antwerp Blue are cyanides of iron chiefly. The first when well made (and the writer has produced this colour by thirty-nine different processes) is safe to use alone in oil. It has a very powerful tinging colour, appearing almost black in a deep layer. The second of these blues differs only in name from the first and in mode of preparation; while the last of the three is distinguished by having a greenish tinge, which the writer considers an accidental property due to the superabundance of ferro-cyanide of potassium, or to the presence of bichromate of potash as an oxidizing agent in the process of manufacture.

Indigo is a vegetable blue, being obtained by macerating the *Indigofera* plant in water. It is a deep, dark, blackish-toned blue, but fades under

exposure to light, and in conjunction with many of the chemical pigments. It gives very good greys with red, and is otherwise a useful colour.

Intense Blue is a deeper toned variety of the last mentioned pigment, but like that one it is not permanent.

Cobalt Blue is a combination of a salt of the metal cobalt with alumina. It is a light blue, totally unlike the other blues of the palette ; it works somewhat unevenly, but is thoroughly reliable, and is most useful for skies and greys.

Azure Blue is a lighter variety of the cobalt blue.

Smalt also owes its colour to cobalt ; but although it is a vitreous compound it is hardly considered permanent, and is unpleasant to work.

Cyanine, or Leitch's Blue, is a mixture of cobalt and Prussian blues partaking of the hues of each ; it is only permanent in respect of the cobalt colour of the mixture.

Ultramarine Blue is most permanent under all conditions to which a painting is submitted. It is the most beautiful and brilliant blue, but somewhat uneven in its working qualities. The genuine variety is made from a rare mineral called *lapis lazuli*, and is obtained only after an elaborate operation ; consequently, its price is almost prohibitory.

French Ultramarine is factitious, or artificial ultramarine, made by chemical means, and possessing all the good qualities of the genuine pigment ; both native and artificial products are permanent alone, and in mixtures, but only the best of the artificial varieties should be used, as inferior specimens are liable to contain superfluous sulphur, which would react chemically on many other pigments.

Permanent Blue, New Blue, French Blue, are only varieties of the last-mentioned.

Ultramarine Ash is a useful pigment ; made from the refuse after making the genuine blue pigment.

Permanent Mauve is a violet toned variety of French ultramarine, it is believed to be equally stable.

Coëlin Blue, or Coëruleum, is a combination of the oxides of cobalt and tin with silica. It is a semi-opaque, greenish-blue, and is practically permanent.

GRAYS AND BLACKS.

Neutral Tint is a compound colour of no permanence.

Payne's Grey is also a mixture which suffers

under the same disadvantage of instability under exposure.

Mineral Grey is extracted from *lapis lazuli*, being the residue of the colouring matter obtained in the preparation of ultramarine ash, and is equally permanent. It is particularly useful in oil.

Lamp Black is the soot of resinous matters, and consists chiefly of carbon; it is, of course, permanent, but dries badly in oil.

Ivory Black is calcined ivory, ground, and mixed as a paint; it is a bad drier. Its composition being mostly carbon it is perfectly permanent, and is indispensible in oil painting.

Blue Black, prepared from wood charcoal, is also a bad drier, but otherwise a good pigment to use.

Black Lead is a permanent pigment, of a dull black hue; it is prepared from carbon in the form of graphite, and therefore absolutely permanent.

SECTION III.

MODERN METHODS OF PAINTING; AND PALETTES OF REPRESENTATIVE PAINTERS, WITH DEDUCTIONS THEREFROM, AND AN IDEAL PALETTE.

The use of a varnish vehicle by the old masters in painting, produced a compound that did not become decomposed, whereas modern painters, instead of keeping to such simple vehicles, indiscriminately mix whatever pigments will combine to produce the hue they wish; and, as if still further to sow the seeds of decay, they employ some nostrum or pernicious vehicle that will bring the mixture into the desired consistence, recklessly regardless of what chemical changes are engendered thereby. There could be nothing more destructive in painting than to incorporate megilp, a compound into which lead enters with a

pigment in which sulphur is present; and yet this and many other bad mixtures are made by the modern painter, because the artist only thereby attains the effects of colouring desired, and so is content to leave the stability of the painting to be discovered after his departure from this world. We could almost wish that their sins could be found out while they yet live, to be a vivid witness against their reckless daring.

The great fault of modern painters is in using too many colours in a mixture; the fewer colours employed the better. By this we do not wish to limit the palette to half-a-dozen colours, but what we would advise is the avoidance of commingling four, five, or more pigments in one mixture for the production of some bizarre hue.

It will be seen on referring to the section on the composition and nature of pigments that they are salts of various kinds from a great variety of metals, besides being extracts from vegetables, insects, &c. Common sense tells us that a mixture of oil, vinegar, water, and sugar, would be anything but agreeable to the digestion; and so we should use similar judgment when laying the palette.

A sulphide, oxide, carbonate, and cyanide of as many different metals cannot reasonably be expected to form a mixture free from disagreeable consequences chemically; nevertheless, this is

what is too frequently done by the modern painter, so that he obtains some uncommon effect, not easily obtainable by his fellow-painters and he is satisfied. The seeds of decay are thus sown ; and as if to hasten the destructive process, vehicles and mediums of the most fanciful and useless kind are employed.

Looked at artistically, such heterogeneous mixtures are wrong, the colours lose their sweetness, and the painting its clearness, so that the result produces a depressing effect of muddy paint as the only object before our vision. The pigments have been muddled out of recognition ; and yet, whatever we turn to in Nature, we find the colouring of the purest, brightest, and most exhilarating kind.

Palette of W. Etty, R.A.—This well-known exponent of figure-painting always believed in using a small number of colours, and especially a few at the same time. At one period of his painting he thought it best to use one colour at a time for painting flesh—or at the most two—letting each layer of colour be seen through. In the first setting he would use yellow ochre or lake to put in the outline with, and in the second setting he would use black and white, with a little red, preferably Indian red. The shades

he would lay in with black and red, totally excluding white from them. These shades he would paint redder than he saw them, so that by scumbling afterwards they would be lowered to the proper tone; as the form took shape he would use white and red towards the high lights. In his earlier style he painted all his half tones smooth, but the high lights thickly. Much of his first painting was afterwards hidden by repainting.

Later, however, he discovered a—to him—new effect; he made a flesh tint of Indian red and white, which, when painted directly on a prepared millboard, emitted a lustre from the light of the white ground behind it, a lustre which Etty deemed very desirable to preserve. Thus forsaking his former method Etty adopted what we may term his second style of practice, viz., painting in the figure with solid white and Indian red to begin with, then allowing the paint to become dry, he would varnish it with copal until he brought it to the tint he wanted, and when the glazing was done he would scumble on the bloom by painting so lightly with opaque colours as to render them semi-transparent. When this, in its turn, was dry, the shadows were glazed in and the lights touched on lightly.

As a ground colour, Etty would sometimes lay

on raw umber, and paint into this while wet; and in one instance, that of laying in the lights and shadows of the *Siren*, he employed tempera.

When at the Academy Life School, Etty would draw in the outlines of his subject with charcoal, then go over this with pen and ink, and afterwards rub in, with his usual vehicle, a little asphaltum over his millboard, touching in the shadows transparently in masses; he then began to paint in the lights, dragging their edges with a free hand into the shadows.

The special vehicle which Etty affected was raw linseed oil, to which was added a little sugar of lead and a few drops of turpentine; or else he would compound a vehicle of one part saturated sugar of lead, one part mastic varnish, and one of linseed oil; sometimes he added a few drops of turpentine. In fact all kinds of vehicles, including wax, were used by him.

In advice to a correspondent, Etty recommends the use of few colours at the same time, giving the following list as forming a good palette:—*Naples yellow*, *light red*, *Indian red*, *vermilion*, *lake*, *terre verte*, *blue*, *raw umber*, *burnt umber*, *black*.

From the above list we notice the omission of a brilliant yellow, and are also left in doubt as to what blue was recommended.

In the same letter Etty gives the following

recipe for a medium :—" A little sugar of lead, " finely ground, about the size of a bean, rubbed " up with your palette knife in a teaspoonful of " mastic varnish ; add to this two spoonsful of " cold drawn linseed oil, and mix them well to- " gether ; if you like, add a little spirits of turps, " as much or as little as you please, and with a " large brush rub over the canvas a portion you " have to put on."

As regards his canvasses, they were prepared for Etty with a rough, absorbent ground ; and he often began his pictures in water-colours, especially so his draperies, &c., which he fixed to the canvas by glazing before proceeding to the regular work of oil painting.

Etty's Method and Palette scientifically considered.—If we are to take it for granted that the palette Etty recommended to a correspondent as containing the colours which he used himself, we have very little fault to find with it from a chemical point of view. The only doubtful colours being the Naples yellow and lake. All the others, excepting vermilion, are absolutely permanent, but only the vermilion suffers change when in strong layers ; in the small amount of it used by this painter we can see little cause to fear the stability of the hue produced in its use as a compound in a flesh tint. When, however, flake white is mixed with it, the two

bodies are disintegrated, and we might therefore look for a change of hue to a leaden tone. But the Naples yellow with white lead, or the pernicious compound used by Etty as a vehicle, would produce disastrous changes of hue in time. Their chemical changes, perhaps, would to a great extent be prevented by the layer of copal varnish laid over the first coat of colour. Sugar of lead employed in a painting sows the seeds of most chemical mischief, both as regards the pigment and the vehicle used.

The Palette of J. A. Storey.—*Ivory black, Vandyke brown, raw umber, brown pink, madder brown, burnt sienna, Antwerp blue, cobalt, emerald green, Indian red, light red, madder lake, extract of vermilion, gold ochre, raw sienna, yellow ochre, Naples yellow, lemon yellow, light Mars orange, flake white.*

About this palette of colours, Mr. Storey says, " If I want blue, for instance, I take some Antwerp " blue and white, and when it is too crude I take " some black, if it is not purple enough I take lake, " &c., so one colour counteracts another or modifies " it, and although the number of different tints or " shades is infinite, this method of producing them " is the simplest in the world."

The medium used by Mr. Storey was cold drawn linseed oil, scarcely any other vehicle being employed by him ; but sometimes he has used

copal ; for sketching in his pictures raw umber and oil of turpentine were used.

Although Mr. Storey's mode of producing tints "is the simplest in the world," we have in such method of mixing one that could not be more heterogeneous unless the full stock of an artist's colour shop was included. Light and yet more light regarding the chemical qualities is certainly wanted with such a palette and such a method of mixture !

The strangest thing about it is that although Mr. Storey was methodical in always arranging his palette in the order given, beginning with black on the left of the palette, yet he pursued an almost indiscriminate method of mixing the colours, the like of which we should advise artists to strictly avoid.

Chemically considered the above palette is made up as follows :—*Vandyke brown* is a pigment which owes its colour chiefly to oxide of iron, *raw umber* and *raw sienna* are mixtures of oxide of iron and manganese, *burnt sienna* is an earthy oxide rendered still more active by calcination. *Indian red* and *light red* are two different oxides of iron, while *gold ochre* and *yellow ochre* are hydrated oxides of iron that contain potash and alumina in their composition. *Naples yellow* is a compound mixture of two metallic salts, and *lemon yellow* is either a

chromate of barium or else a mixture of sulphate and chromate of lead combined with other bodies. *Light Mars orange* is an artificial ochre, *flake white* is a mixture of carbonate and hydrate of lead, while *ivory black* is essentially a mass of carbon intimately combined with tarry matter. *Cobalt* is a silicate or phosphate of cobalt. *Antwerp blue* a cyanide of iron and potassium. *Emerald green* is a compound of copper and arsenic, and *brown pink*, *madder brown* and *madder lake* owe their origin to a vegetable source, and, finally, *extract of vermilion* is a sophisticated sulphide of mercury. Surely this is a representative palette of all the colours found in an artist's repository ; we cannot conceive of any mixture made with any of these colours that would not be antagonistic. To attempt to depict the chemical reactions that would be likely to occur would be an endless task, especially as Mr. Storey follows such a careless way of compounding his tints.

H. W. B. Davis' Palette.—This painter lays his palette as follows :—*Flake white, light Naples yellow, lemon yellow, cadmium pale, medium, and deep ; Indian yellow, yellow ochre, golden ochre, vermilion, rose madder, best crimson lake or carmine, cobalt blue, French ultramarine, madder brown* (sometimes used), *burnt lake, light red, Indian red* (sometimes used), *raw sienna, burnt sienna, raw*

umber, burnt umber, Vandyke brown, ivory black (or some other black), *terre verte.*

Mr. Davis, replying to a correspondent regarding the colours used, speaks well in favour of cadmium, of which he is enamoured, but, as regards one mixture he at one time made, he found that the cadmium was an unsafe one, thus to quote Mr Davis: "I recollect some years ago discovering "that cadmium turned black in conjunction with "emerald green, but inasmuch as I have, so to say, "discarded the latter from my list of colours, the "list does not hold good." It would be interesting to know at what time this discarding of emerald green took place. The writer has observed in one picture ("The Return to the Fold") that the glint of the setting sun has darkened considerably during the last ten years, whilst in some places patches of a faint pink and a sapphire bluish-green appear in the sky, an evening effect which the artist seems to have attained by scumbling over a layer of cadmium yellow.

As regards the above mixture of cadmium and emerald green, it certainly is a most dangerous one to make. Emerald green is never safe, unless locked up by itself in a quick drying varnish, as it is so readily decomposed, the copper compound of it being easily affected by the presence of sulphur, which is an essential ingredient of the cadmium

yellows. The darkening that occurs in the mixture of cadmium and emerald green is due to the production of black sulphide of copper.

If we classify Mr. Davis' palette according to the chemical compounds we shall have, as *oxides* (*of iron*) light red, Venetian red, Indian red ; (*earthy*) yellow ochre, golden ochre, raw sienna, burnt sienna, raw umber, burnt umber, Vandyke brown.

Sulphides (*of cadmium*), pale, medium, and deep cadmium yellows ; (*of mercury*) vermilion.

Chromates (of lead or barium), lemon yellow.

Compound colours (*mixtures of metallic salts*), flake white, light Naples yellow, cobalt blue, French ultramarine, Antwerp blue, terre verte ; (*of organic origin*) Indian yellow, rose madder, crimson lake, madder brown, ivory black.

Out of the above list the following are the colours that cannot be depended upon for durability. The cadmiums, vermilion, flake white, Naples yellow, Antwerp blue, Indian yellow, crimson lake. The rose madder and madder brown are doubtful in permanence when compounded with ivory black, for owing to the bleaching action of this organic black the vegetable colours are liable to lose their colour in time. With regard to vehicles Mr. Davis is of opinion that too much importance is often attached to the subject of mediums, and thinks that it is immaterial what

vehicle is selected by the painter, for he usually employed what medium best suited his manner of painting. This opinion the writer cannot endorse, for even a pigment of unsafe composition can be securely protected from change if properly locked up in a suitable vehicle. In fact, much of the mischief of decay in paintings is due to the indiscriminate and reckless choice of vehicles which are employed merely because they suit the painter's technical method. In Mr. Davis' own practice he has sometimes used the tube colours without diluting them with any vehicle, at other times he has used turpentine and even benzine; the latter fluid he liked because it was less greasy than turpentine, being perfectly volatile, which in Mr. Davis' opinion was an advantage. As a consequence of its volatile nature, this thin fluid has no binding property, but the greasiness of turpentine is due to the small amount of resin, which on evaporation of the spirit is found left behind. When glazing this small quantity of resin has the effect of fixing the colours to the painting ground. Another favourite vehicle of Mr. Davis was the "*Siccatif de Haarlem*," but he was not content to use even this alone, for he mixed one part with two parts of benzine, and for a flowing vehicle for skies he made a mixture of linseed oil and benzine which enabled him to wash the colours easily without overloading them with oil.

From the great variety of vehicles Mr. Davis used, one is not far wrong in believing that he could never have found a perfect one. Truly a more heterogeneous mixture could not well be used by a single painter. Will his pictures stand? Time alone can tell.

The following palettes used by some few R.A.'s and A.R.A.'s will form a representative list of colours used in modern oil painting:—

Palette of Sir Frederick Leighton, P.R.A. In Landscape.—*Ivory black*, *cappah brown* (not reliable), *burnt sienna*, *raw sienna*, *Roman ochre*, *yellow ochre*, *French Jaune de Naples*, *aureolin* (doubtful) *cadmium* (liable to darken alone or in mixture).

For skies: *cobalt*, *pale lemon yellow*, *and vermilion.*

Supplementary colours: *deep lemon yellow*, *flake white*, *vermilion*, *Venetian and Indian reds*, *rose madder*, *cobalt*, *emerald oxide of chromium* (viridian).

In this palette we find several pigments that are not absolutely reliable. Flake white, with cadmium or vermilion, will certainly darken in time; and so will the lemon yellow (if lemon chrome) with cadmium or vermilion.

For Flesh.—Sir Frederick mixes *cobalt* and *emerald oxide of chromium* with *white* in gradations. There is nothing to say against this

mixture; but in the case of *vermilion and lake*, which is also mixed with *white*, there is a decided objection, because lake is liable to be weakened in time by the white, and there is the chance of the sulphide of mercury (vermilion) acting on the carbonate of lead (in flake white) and producing the black sulphide of lead.

Palette of Vicat Cole, R.A.—Of the following fourteen colours used by this artist, with the exception of the two last, all can be freely mixed together without fear of being decomposed, as they do not act chemically on each other. In fact it is almost a perfect palette as regards permanent colours:—*Zinc white, cobalt green, cobalt blue, ultramarine, lemon yellow, yellow ochre, raw sienna, burnt sienna, light red, Indian red, madder lake, raw umber, cadmium yellow, cappah brown.*

Palette of J. C. Hook, R.A. For Figure Painting.—*White, Naples yellow* (unsafe), *yellow ochre, Roman ochre, vermilion* (uncertain), *Indian red, rose or crimson madder* (if of cochineal unsafe), *deep lemon yellow and cobalt mixed, purple madder, cobalt, French ultramarine, Vandyke brown, plumbago.*

For Landscape.—*White, Naples yellow, deep lemon yellow, yellow ochre, Roman ochre, deep lemon yellow and ceruleum or cobalt mixed, cobalt, French*

ultramarine, vermilion, Indian red, purple madder (unsafe), *Vandyke brown, plumbago, real ultramarine* (exceptional).

Palette of W. W. Ouless, R.A.—*Flake white, lemon yellow* (not for flesh), *yellow ochre, raw sienna, burnt sienna* (never for flesh), *raw umber, Vandyke brown, ivory black, extract of vermilion* (doubtful), ordinary *vermilion* (not always safe), *pink madder* (uncertain in its action). *Cobalt, French ultramarine* (supplementary).

Palette of Luke Fildes, A.R.A.—*Flake white, yellow ochre, Roman ochre, raw sienna, citron yellow, light red, cobalt, ultramarine ash, terre verte, oxide of chromium, brown madder, bitumen* (should be rigorously avoided on every palette), *Verona brown, ivory or blue black.*

Supplementary colours: *yellow lake* (most fleeting), *burnt vermilion* (uncertain), *rose or carmine madder, raw umber, Caledonian brown real ultramarine, emerald green* (a most unsafe green).

Palette of Val Princep, A.R.A.—*Flake white, lemon yellow, pale cadmium* (unsafe), *raw sienna, vermilion, rose madder, Indian red, Venetian red, cobalt, Antwerp blue* (unsafe), *oxide of chromium* (supplementary), *Naples yellow* (unsafe), *French ultramarine.*

IDEAL PALETTE OF PERMANENT COLOURS.

From the foregoing selection of representative palettes, and from what has already been said respecting each colour, we can form an *Ideal Artist's Palette* of colours, which shall be permanent, whether used alone or in conjunction one with the other.

Ideal Palette for Figure Painting.—*Cobalt, oxide of chromium, yellow ochre, Roman ochre, burnt sienna, Indian red, French ultramarine, Vandyke brown, ivory black, raw umber, raw sienna, lemon yellow* (of barium), *Venetian and light reds, zinc white, permanent crimson* and *scarlet vermilion.*

Ideal Palette for Landscape.—*Ivory black, burnt and raw sienna, Roman ochre, yellow ochre, lemon yellow* (of barium), *Venetian, Indian, and light reds, cobalt, emerald oxide of chromium* (*Viridian*), *opaque oxide of chromium, French ultramarine, Vandyke brown, real ultramarine, terre verte, permanent crimson, Verona brown;* and for a bright yellow choose a well-made *cadmium yellow* (*radiant yellow*), ground up in a varnish vehicle, and avoid using a drying oil, megilp, or any vehicle which has been prepared with sulphuric acid or salts of lead.*

* Linseed oil is often rendered drying by means of sulphuric acid which is afterwards washed out of the oil with water or thrown

An oil prepared with acid would react and darken chrome yellow, while sugar of lead would darken cadmium yellows.

For a bright red, *Chinese vermilion*, or cinnabar, ground up in a varnish vehicle should be used. For rose tints and purples the new *permanent crimson* will take the place of the lakes and madders; if mixed with Vandyke brown or with burnt sienna and a dash of ultramarine, the most useful tint of brown madder can easily be matched.

If such colours as those given in these Ideal Palettes were adhered to, we should certainly expect pictures painted therewith to withstand atmospheric effects and other detrimental causes that impair modern paintings.

down by a salt of barium, but oil so prepared can seldom be entirely free from impurities.

SECTION IV.

COMBINATIONS OF COLOURS FOR PRODUCING VARIOUS HUES.

The following mixtures to produce various hues are such that the components do not chemically react on each other :—

Brick Colour.—Yellow ochre, light red, and flake white in suitable proportion.

Bronze Green.—Opaque oxide of chromium, burnt umber, green predominating.

Brown (ordinary).—Light or Venetian red, black and yellow ochre.

Canary Yellow.—Flake white and lemon yellow (of barium).

Carnation Red.—Permanent crimson and zinc white.

Chestnut Brown.—Light or Venetian red, lamp or ivory black, lemon yellow (of barium).

Chocolate Brown.—Indian red and black to form a brown, then add yellow ochre and lemon yellow to bring about the desired shade.

Citron.—Light red, yellow ochre, cobalt blue in proportion to produce the desired hue.

Claret Colour.—Indian red and black, or permanent crimson and ultramarine.

Clay Drab.—Raw sienna, raw umber, flake white, and a touch of opaque oxide of chromium.

Copper Red.—Light red, yellow ochre, black.

Cream Colour.—Flake white, yellow ochre, and light red.

Deep Buff.—Yellow ochre, flake white, and a little light red.

Dove Grey.—Light red, flake white, cobalt blue, and yellow ochre. If vermilion be used instead of light red, zinc white should be substituted for flake white.

Drab (ordinary).—Flake white and a small quantity of burnt umber.

Fawn Colour.—Flake white, a little of each light red and burnt umber, and a slightly larger quantity of yellow ochre.

French Grey.—Flake white tinted with ivory black.

Greens.—Transparent oxide of chromium and radiant yellow for deep, rich *greens and russets of Autumn.* Transparent oxide and aureolin for the more *sunny Autumn greens.* Lemon yellow and cobalt blue for the tender *greens of Spring.*

Lead Grey.—Flake white, and one-eighth each black and French blue.

Lemon Yellow.—Lemon yellow with half as much flake white.

Light Buff.—Yellow ochre and flake white.

Lilac.—Venetian red, flake white, and cobalt or French blue or permanent mauve and white.

Maroon.—Permanent crimson with a little lemon yellow (of barium).

Oak Wood.—Flake white and an equal part of yellow ochre.

Olive Green.—Yellow ochre, French blue, and black; or as shadows to bright and warmish yellow-greens, mix burnt sienna with a little aureolin and French blue.

Orange.—Aureolin and burnt sienna. This hue is useful for the autumn tints and to mix with the other greens, in order to vary their tone and depth.

Peach Blossom.—Flake white and equal parts of light red, cobalt blue and lemon yellow (of barium).

Pea Green.—Flake white, and one-fifth part of opaque oxide of chromium.

Pearl Grey.—Flake white, black and light red in proportion to suit lustre.

Plum Colour.—Flake white, Indian red, and French blue.

Portland Stone Drab.—Raw umber, yellow ochre, flake white.

Rose.—Zinc white and permanent white, and permanent crimson.

Salmon Pink.—Flake white, lemon yellow, and a little burnt umber and Venetian red.

Snuff Brown.—Yellow ochre and Vandyke brown.

Stone Drab.—White, yellow ochre and burnt umber.

Straw Yellow.—Yellow ochre or lemon yellow, flake white, and a little red.

Tan.—Burnt sienna, yellow ochre, and raw umber.

Violet.—Similar to lilac, but bluer and redder than purple.

Willow Green.—Zinc white and verdigris (in varnish vehicle).

It is next to impossible to give cut and dried quantities of each colour to take in any one mixture, because the consistence of the colours in the tubes vary considerably.

In making experimental blends of colours as given above, the artist will, however, derive a large amount of useful information in compounding permanent mixtures.

SECTION V.

COLOURS AND THEIR COMBINATIONS FOR FLESH PAINTING, BACKGROUNDS, LANDSCAPES, &c.

Setting the Palette for Flesh Painting.

The chief colours from which all tints required for painting flesh are :—

Flake White should be ground in poppy oil, linseed oil, megilp or ordinary drying oil (prepared with lead), or any colours that contain sulphur in their composition should not be mixed with it.*

Yellow Ochre ground in poppy oil.

Raw Sienna.

Light Red.

Vermilion.

Permanent Crimson requires drying oil.

Cobalt.

* In any case it is better to avoid the use of oils which owe their drying properties to lead salts. Reeves' special drying oil prepared with manganese salts is equally effective and is less likely to be injurious.

Burnt Umber.

Ivory Black requires addition of drying oil.

Terre Verte.

Some examples of the tints which may be compounded from the above list are :—

White, yellow ochre, and a little light red	Lights.
„ with a dash of yellow ochre	
„ yellow ochre, and crimson ...	
„ vermilion, and crimson ...	
„ cobalt, and light red ...	Middle tints.
„ light red, and terre verte ...	
Light red, burnt umber, and a little crimson	Shadows.
Terre verte, burnt umber, light red, and white	
Raw sienna, crimson and burnt umber	
White, black, and cobalt	Eyes.
Raw sienna, burnt umber, and white	
White, cobalt, terre verte, black ...	
Vermilion, crimson, cobalt, and white	Lips.
Crimson and burnt umber	
Black and burnt sienna	Hair.
„ „ umber	
„ „ sienna, and crimson	
Raw sienna, crimson, and burnt umber	

Yellow ochre and white		
Black, white, and cobalt		Hair.
Raw sienna and white, &c.		

Colours and Tints for Backgrounds for Portraits.

The principal colours required for painting backgrounds, such as walls, buildings, or the like, are white, black, Indian red, yellow and brown ochre, French ultramarine, viridian, and burnt umber. From these colours are compounded the following eight principal tints :—

Black, white, and a little Indian red.

Black and white, mixed to a dark lead colour.

Brown ochre and white.

Yellow ochre, white ultramarine, and a touch of viridian.

Indian red and white mixed to a middle tint.

Indian red and white and a little black mixed to a kind of purple or middle tint.

White, burnt umber, black, and Indian red.

Black and Indian red.

All the colours should be laid with drying oil only, because they mix and set better with the softener.

Colours and Tints used in Landscapes.

The principal colours are *flake white*, *yellow ochre*, *brown ochre*, *burnt umber*, *ivory black*, *blue black* (*charcoal black*), *Prussian blue*, *ultramarine*, *cobalt*, *terre verte*, *viridian*, *permanent crimson*, *Indian red*, *vermilion*, *cadmium* (*radiant yellow*), *lemon yellow* (of barium), *aureolin*, *raw sienna*.

The principal tints are—

Yellow ochre and white.

Yellow ochre, Prussian blue and white.

Yellow ochre and Prussian blue in two tones, light and dark.

Terre verte and Prussian blue.

Brown ochre, ultramarine, and viridian.

Indian red and white.

Ivory black, Indian red, and white.

Aureolin, cobalt, and a little crimson.

Aureolin and viridian.

Radiant yellow and viridian.

Radiant yellow and blue black.

Crimson, burnt sienna, and a dash of ultramarine, for colour of brown madder.

Crimson, raw sienna, and ultramarine, for colour of brown pink.

The principal colours for painting the sky are *flake white*, *ultramarine*, *cobalt blue*, *yellow ochre*, *vermilion*, *crimson*, *Indian red*.

Some tints are—

Cobalt and white in different tints.

Ultramarine and white in different tints.

Yellow ochre and white.

Vermilion and white.

Vermilion, cobalt, and white.

To the above list the artist will add whatever permanent colours his experience may show him to be necessary.

SECTION VI.

PAINTING GROUNDS.

The Old Masters' painting grounds were formed of calcined sheep's-trotters, pounded and mixed with glue or fish size; and the remarkable brilliance of many of the Venetian paintings after several centuries testifies to the excellence of this preparation. In truth it is chemically more permanent than the modern "prepared canvas," because the ground of the latter material is composed of a mixture of linseed oil, white lead, and driers (litharge, or "sugar of lead," &c.). These consist of a very pernicious compound to bring into contact with oil colours, because the lead base is liable to react chemically on paints spread over it, and also because it absorbs sulphurous fumes and darkens thereby, which darkening cannot fail to dim the brilliancy of light colours and delicate hues.

Prepared Canvas, painted with white lead, is so extensively used that some means of knowing how to minimise its injurious reactions is useful to know.

One good method is to paint the back of the prepared canvas with a coat of zinc white in linseed oil or else in white lead, over which another coat of zinc white is laid. A second preventative is to paint over the white lead ground of the canvas with either zinc white or else a thin coat in oil of umber, accordingly whether the painting is to be light or dark in its tone of colouring. Even a coat of linseed oil put on and allowed to dry thoroughly will minimise the evils incidental to painting on a lead ground.

The practice adopted by some painters of backing their canvasses with prepared canvas reversed, cannot claim to be very effectual in preventing the darkening of the painting ground by absorption of noxious gases; but an extra backing of canvas is a precaution to be recommended against accidental damages. Artists' colourmen would do well to prepare their canvasses somewhat on the lines of the old Venetian painters.

Of the colour of painting grounds, we have it on the authority of Mrs. Merrifield, that "One cause "of the purity and beauty of the colours in ancient "paintings is the care with which the grounds "were prepared. When these were not of gold, "they were invariably white; and we find, from "the work before us, that no pains were spared to

" preserve them, pure, clean, and bright; for on " this the success of the painting appeared to " depend. 'All they,' says De Piles, the com- " mentator on Du Fresnoy's *Art of Painting*, 'who " have coloured well, have had another maxim " to maintain their colours fresh and flourishing, " which was to make use of white grounds, upon " which they painted, and oftentimes at the first " stroke, without retouching anything, and without " employing new colours. Rubens always used " this way; and I have seen pictures from the " hand of this great person, painted up at once, " which were of a wonderful vivacity. The " reason why they made use of those kinds of " grounds is because white not only preserves " a brightness under the transparency of colours, " which hinders the air from altering the whiteness " of the ground, but also repairs the injury which " they receive from the air, so that the ground and " colours assist and preserve each other. It is for " this reason that glazed colours have a vivacity " which can never be imitated by the most lively " and most brilliant colours; because, according " to the common way, the different tints are laid " on each in its place, one after another. So true " is it that white, with other strong colours, with " which we paint at once what we intend to glaze, " gives life, spirit, and lustre to the work. The

" ancients most certainly found that white grounds " were much the best; for although they were " conscious of the injury which their eyes received " from that colour, yet they did not forbear the " use of it.'" In his tenth book *Of the Use of the Parts*, Galen says: "Painters, when they work " upon white grounds, place before them dark " colours, and others, mixed with blue and green, " to refresh their eyes; because white is a glaring " colour, which wearies and pains the sight more " than any other."

Panels.—There are many points in favour of painting on wood. Correggio, Rubens, and many of the great masters of the Italian, Flemish, and Dutch schools used this material as a painting ground after previously preparing the surface with white.

Pearwood, boxwood, and oak were generally employed for making panels, and for very large ones, the boards were cemented together with a glue made from cheese, that formed the panel into a wide board, as firm as if made out of a solid plank.

Mahogany is now almost invariably used for panels, but they are not very extensively employed on account of their greater cost compared with other grounds. Unless carefully prepared they are liable to warp or split, but if properly made they

are preferable to any other form of ground for moderate sizes. In order to preserve them flat the wood must in the first instance be very carefully selected, and they should be painted with an equal quantity of colour on *both* sides.

Millboards are a modern invention prepared with a surface similar to the panels.

Academy boards are a cheaper form of millboard with less preparation and less fine in texture, they are suitable for out-door sketches and studies. They are in every way adapted for the purpose for which they were intended.

Paper.—Ordinary paper is of course not suited for oil painting, as the oils and vehicles become absorbed, and the paint will not become attached to it. The prepared paper known as "oil sketching paper" is, however, perhaps the most convenient and economical ground for out-door sketching. It can be obtained finished with a smooth surface or with a grain in exact imitation of canvas. For touring it will be found very portable, especially in the form of a sketching "block" composed of a number of sheets compressed together, each sheet being removed as used without disturbing the rest.

All the surfaces of the grounds, canvas, panels, millboards or paper are prepared in a similar way. The preparation of the canvas particularly occupies

much time, and is carefully manipulated in order to render it smooth and pliable. The English prepared canvas is much preferable to the foreign, because the English is generally prepared solely by hand and much of the foreign is coated by machinery. Hand-prepared canvas is stretched to its utmost tension, and prepared in this state it will not give to any appreciable extent afterwards ; but machine-prepared canvas cannot be coated whilst the cloth is in a state of tension, the consequence is that the cloth will afterwards still stretch considerably, and the surface not being equally elastic is liable to crack. For large sizes canvas is the only available ground, in fact it is manufactured by Messrs. Reeves in pieces without a join as large as 13 feet by 20 feet.

The white colour used in its preparation being white lead, it cannot be depended upon to keep its colour entirely. Some pieces originally white, which the writer has put by during the last twenty years, are of a dun grey or chamois colour, although they have been exposed only to ordinary atmospheric influences. If the canvas were prepared with some white substance other than white lead, as, for instance, sulphate of barium and zinc oxide, or silica, or zinc sulphide in an oleoresinous medium, or drying oil prepared without alkali or acid, we might expect such a canvas to retain its colour

and not be darkened when exposed to foul air.

The early oil painters prepared their panels with two or three coats of size, then a layer of coarse gesso (a kind of plaster of Paris) and on this at least eight layers of a finer description of the same material. In the Italian school of a later period the grounds were generally of pipe-clay mixed with chalk.

Canvas is also prepared with the object of absorbing the oil from the first layer of colour; it is called "absorbent."

SECTION VII.

OBSERVATIONS ON THE BEHAVIOUR OF OIL PAINTS AND THEIR MEDIUMS.

USE AND ABUSE OF VEHICLES.

A **pigment** should not only be permanent in itself, but the medium incorporated with it to form it into a *paint* should be one that is thoroughly reliable under all conditions.

These conditions are—

That it does not disintegrate the pigment with which it is mixed, nor become disintegrated itself.

That it is not decomposed by atmospheric influences, such as sunlight, cold, damp, foul air, light or darkness.

Provided that the pigment is permanent and the vehicle incorporated with it fulfils the above conditions, it does not necessarily follow that the *paint* so formed is a perfect one.

In fact a **paint** is not perfect unless it fulfils the following conditions :—

Keeps its place on the canvas.

Dries firmly and solidly throughout its depth, and therefore does not exhibit wrinkles, puckers, or forms a skin of hard oil.

That the pigment does not sink away from the oil or medium.

That the oil or medium is not absorbed by the canvas or painting ground.

A **medium** is the oily megilp or other nostrum employed with the paint to render it capable of executing the desired technical difficulties. While a **vehicle** is a medium employed to give colours a drying quality and to render them thin and transparent enough to be laid over other colours, as in "glazing," as this technical method is termed.

Even though the paint itself may be perfect it is often rendered imperfect, *i.e.* impermanent, by the improper use of vehicles.

A *perfect paint* should be one that fulfils its purpose without any extraneous additions of vehicles or mediums applied in the raw state. Thus if opaque colours were ground stiff for solid painting, and transparent colours were found limpid or thin for glazing purposes, there would be no need of adding a "thinning vehicle," as turpentine, to the tube colour, as is now the practice. This is, in fact, a practice much to be condemned, because the grinding of the pigments and oil has produced a homogeneous product, but if, to this

mixture, an addition be made on the palette—as, for example, thinning the tube colour with turpentine or megilp—such additions do not become thoroughly incorporated with the paint, and so, in time, show the evil effects of such incomplete combination. We have an example in the case of adding raw linseed oil to a tube colour while painting. This raw oil will not dry at the same rate that the tube colour would alone, and, as a consequence, the painting subsequently becomes cracked, wrinkled, or otherwise disfigured, solely because the raw oil has not been incorporated thoroughly with the paint like that which had been ground up with the pigment.

As a general rule, each painter has a favourite nostrum or vehicle which he has faith in, such confidence having been engendered because this particular nostrum conduced to his desired effects in some one particular manner. Now from the diverse composition of pigments, the lakes, of vegetable origin ; sepia, cochineal, &c., of animal origin ; and the many other colours of mineral origin—it will be granted that it is next to impossible for any one particular vehicle to suit one and all colours alike.

The only safe mediums are drying oil prepared with manganese or the "Oleoresinous medium," which is not entirely an oil nor altogether a

varnish. In respect of choosing the right vehicle, the painter cannot be too cautious.

The vehicles to avoid are all those that have been prepared with sugar of lead, sulphate of zinc, sulphate of calcium, boiled oil; which has usually been incorporated with lead salts or acids to render it drying; last of all, megilp, which is a favourite but noxious compound of mastic resin, with lead prepared drying oil.

If a dryer is at all needed, it should be sulphate of zinc calcined or borate of manganese; these bodies do not act injuriously on linseed oil when added thereto to render it drying.

Owing to the difficult drying qualities of pigments, the colourman has to manipulate the incorporating mediums with some one or other of the above salts. The two last-named should only be used. The writer has invented an oleoresinous medium that combines well with all colours, and when ground up with pigments cause the painting to dry firmly and solidly throughout their depth and without the addition of any dryer.

The addition of a raw oil to copal or amber varnish for use as a vehicle for glazing colours should be avoided, for the varnish, if properly made, has had its necessary quantity of oil incorporated with it, and the addition of raw oil only serves to spoil the varnish, because, under the

conditions of such empirical mixture, thorough incorporation of varnish and raw oil does not, and cannot take place. The varnish by itself would dry very fast, the raw oil alone would dry very slowly, consequently, when the two are mixed, such mixture would dry at different rates and so cause ridges or wrinkles, and, later on, with the probability of the paint cracking and peeling off when thoroughly dry.

Copal and amber varnish should never be mixed together, because copal varnish on drying contracts, and, therefore, if mixed with a varnish that does not do so, or laid on a surface of paint that dries at a different rate to itself, the contracting of the copal varnish would dry up the paint and expose the canvas ground beneath.

Turpentine as a vehicle.—This spirit is used too frequently on the palette. In itself it has no artistic qualities, since it evaporates, leaving behind a sticky pellicle of resinous matter without any binding properties whatever; the only plea that artists can offer for its use is that it thins the colours used for glazing, but with this favourable exception, its physical and chemical bearing when mixed with paint is detrimental to the mixture. When turpentine is mixed with the colours on the palette it does not become incorporated with them, and when they are laid on the canvas the

spirit evaporates, leaving them dull and bereft of a great part of their beauty. If the paint over which the mixture of turpentine and pigment is laid be still moist, the turpentine will be imbibed even to the extent of being absorbed by the painting ground, and, as a result, leaving the surface of paint "dead."

Besides the physical drawbacks to the use of turpentine as a painting vehicle it has chemical ones, which likewise render it detrimental in a painting.

Lavender Oil.—It has been recommended to use oil of spike or lavender oil as a substitute for turpentine, this essential oil is preferable in some points, but it should be known that oil of spike lavender dissolves oil itself, and even hard, obdurate varnishes; consequently, if mixed too freely with paint, it would set up disintegration thereof by dissolving the oil incorporated therewith.

The safest way to use this essence as a thinning vehicle, is to mix up a small quantity with a large quantity of linseed oil and then thin the paint with this mixture. I have seen it mentioned that naphtha and oil of petroleum are useful as thinning vehicles. They are decidedly the opposite, as both these fluids have no qualities whatever to fit them for a painter's purpose. These

remarks about fluid petroleum and its analogues do not apply, however, to the solid white paraffin wax; this substance is useful to the artist in the preparation of vehicles for special purposes.

Varnishes.—Great and permanent injuries are done to paintings by the improper use of a varnish. The practice of the Old Masters was not to varnish a picture until five years after painting it; this is a good procedure to follow, as it has sound reason on its side; but I fear the exigencies of the conditions under which modern paintings are produced preclude the possibility of following so sound a practice. The painter of to-day cannot well keep a commissioned portrait in his studio for several years; and to send the painting home without a coat of varnish would, I fear, often lead to the repudiation of the commission. A coat of varnish, like a good cloak, covers up a host of evils in the shape of dull patches of paint that have been loaded with turpentine; lumps of hard paint that have become dull by the use of too much drier; sticky patches of paint that have been made into a soap with megilp; all these blemishes in a painting are glossed over by a coat of varnish while it is fresh; when dry, however, the evils are intensified, and the picture a wreck.

The proper time to apply a coat of varnish is not until twelve months have elapsed after the painting is executed. To preserve the colour fresh and bright when dry on the surface, the painting should be brushed over with a solution of white of egg and loaf sugar dissolved in water. When the necessary time comes round for varnishing, this coat of albumen is cleaned off by softly sponging the painting with warm water, then allowing it to dry for a day or two, and finally a coat of varnish laid on at a temperature of 70°, in a dry atmosphere, free from dust and draughts. No moisture nor cold draughts should be allowed to enter the varnishing room until the varnish is set, *i.e.*, no longer "tacky." To keep the room free from moisture, saucers containing chloride of calcium might be placed about the room.

In varnishing a picture, it should be placed in a deep box, which is an excellent means of preventing sudden draughts from sweeping over the varnished surface.

The choice of varnish is of great moment. A hard varnish, like copal or amber, should not be laid on a picture whilst the paint is still wet (*i.e.*, not dry throughout), because such varnish, as it dries at a quicker rate than the paint beneath it, will drag up the latter, and so cause fissures and cracks in time.

Copal is especially prone to do this, since the varnish made with this resin contracts on drying.

On the other hand, if a hard varnish be laid on a picture, the paint of which is very hard and dry, such varnish will cause the paint to peel off as the varnish dries, such action being due to the latter's strong adherence to the paint and combination in drying, which causes the paint to peel away from the canvas.

In varnishing old paintings, or those in which the paint is dry and hard, it is best to lay a cushion of oil on the paint a day or two before applying the varnish. A mixture of half-a-pint of linseed oil to half-an-ounce of oil of spike lavender mixed with it forms an excellent medium for such cushion; the *rationale* of such a proceeding is that this mixture gradually softens the hard paint, so that when the varnish is applied it unites directly with the paint, and then forms a homogeneous whole.

If mastic varnish be applied, such mixture of linseed oil and spike oil should not be used, because mastic varnish is a brittle one, and easily removed by friction; and if this becomes incorporated with the softened paint, it could not be subsequently removed if needed, or the picture "cleaned" without the risk of some of the fine glazings in the painting being also removed with it.

The reason for delaying the varnishing process until the paint is dry, is this :—

A coat of paint dries by absorbing oxygen, usually from the air, but also from some pigments rich in that element; consequently, the surface of the paint will become dry while the underneath part is still wet (*i.e.*, soft), and thus, as the dry surface becomes thicker, the paint next to the ground will remain a considerable time before it can receive its complement of oxygen to render it dry and hard.

Therefore, if a coat of varnish—which dries at a quicker rate than the paint—be applied on paint still wet, it is obvious that the latter will take still longer to dry; and not only this, but be pulled off the ground by the quicker drying varnish.

SECTION VIII.

SOME TERMS USED IN PAINTING DEFINED AND PRACTICALLY CONSIDERED.

Terms Applied to Colours.

Primary colours are those which cannot be compounded by mixture of other colours. Our space will not permit us here to enter into the question of which colours should be considered as true primaries; suffice it to say that material colours or pigments, in mixtures, do not follow the same laws as coloured rays of light; and therefore, for the purposes of the painter, the three colours, *red*, *yellow*, and *blue*, are assumed to be the primary colours, because they cannot be compounded from the mixture of other colours.

Secondary colours are those produced by the mixture of any two primaries. Thus:—

Red and yellow	produce	*Orange.*
Yellow and blue	„	*Green.*
Red and blue	„	*Purple.*

Tertiary colours are mixtures of any two secondaries.

Green and orange	produce	*Citrine.*
Orange and purple	„	*Russet.*
Purple and green	„	*Olive.*

Complementary colours are any two which, between them contain a proper proportion of each of the three primaries to form a harmony.

Red	is complementary	to	*Green.*
Yellow	„	„	*Purple.*
Blue	„	„	*Orange.*
Orange	„	„	*Olive.*
Green	„	„	*Russet.*
Purple	„	„	*Citrine.*

Neutral Tint is a mixture of the three primaries in a proportion to neutralise each other.

Harmony in colouring is the just adaptation to a picture of the three primary colours in proper proportions, either pure or mixed, so as to impart a pleasing sensation of rest to the eye without any of the colours predominating.

Contrast is the juxtaposition of two dissimilar colours, whereby the effect of each is intensified. The study of due contrast in every work of art is essential to a fine effect.

Tint is a term used for gradations or mixtures of colours with white.

Hue is the variation of a primary colour by mixture with a secondary.

Shades of Colour are colours or hues darkened to a greater or less degree by the addition of black. In painting, the term shade has a distinctly different meaning. Shade or shadow in a picture is the representation of those parts of objects which are not seen in full illumination. In this connection, Ruskin says, "It is an absolute fact that shadows "are as much colours as lights are; and whoever "represents them by merely the subdued or dark-"ened tint of the light, represents them falsely."

Tone expresses the degree of luminosity of the prevailing hue in a colour, but the term is not synonymous with *tint*, the latter relates rather to the mixture of colours, and the former to their effect. Cobalt is a light toned blue, and Prussian blue a dark toned blue, they are different tones but not tints of blue.

Grey is the mixture of black and white in various tints.

Grays or *broken colours* are the mixtures of colours with their complementaries.

Local Colour is the natural colour of an object as it appears when viewed in white light. In a landscape, objects gradually lose their local colour and assume a sky tone as they recede from the eye.

Terms used in Practice.

Laying-in or Dead Colouring is the first process in painting a picture. It consists of painting the lights and shadows with simple colours as a ground work, a small quantity of colour being used, especially in the shadows. The general effect should be a middle tone, without glaring colours in the light parts or too powerful tones in the dark. All the light parts must be kept lighter in this stage than they are intended to be when finished. The minute details should be omitted.

The laying-in should present a quiet atmospheric and general effect. The great art is to use two colours, which shall serve for the ground of the shadows in general (the sky excepted), and the method of using them with the lights. It is necessary that they be laid in a careful manner, avoiding blending or mixing on the picture, as much of the success of the after processes depends upou this preliminary stage.

Painting in detail is the *second painting*. At this stage attention must be given to the drawing, and all minor details and characteristics must be observed. The process is similar to the former, but the quantity of colour used in the light parts must be greater, and the shadows, whilst thin, must be more transparent. Great care must be observed

with the lights, in order to preserve their character, and the half tints must be carefully blended with the shadows to give the effect of relief. It will be found that, where the first tint approaches the colour desired, it will not be advisable to disturb it.

Glazing is executed by laying over other colours a thin, and generally speaking, transparent film of colour to modify the tone or to heighten the effect, the work beneath appearing through, though altered in colour by the glaze, which may be applied in partial touches, or broad flat tints.

Glazing is not confined to the use of transparent colours only, for although the colours which lie beneath should appear through the glaze, yet a thin layer of an opaque colour may be used, provided it is more diluted than if it were transparent, as transparent colours have always less body than the opaque, and are therefore naturally more suited for the purpose of glazing. The semi-transparent colours such as light red, Indian red, the ochres, and such colours may be used, but care must be taken not to carry this process to excess, for, if this is done, the work will inevitably suffer.

Glazing will give warmth, strength, or coolness to the shadows ; it will also subdue the brightness of the obtruding parts, and may be used to produce the effect of smoke and mist ; its great value is in generalising and giving breadth of effect and tone.

Glazing should, however, be resorted to with great caution, and to apply it successfully, both practice and experience are required. In old paintings the glazings have proved to be least permanent and naturally the process has been looked upon with distrust, but it is a power in the hands of the artist which cannot be dispensed with; artists, however, need not fear for the future if they adhere to the principles set forth elsewhere with regard to permanent pigments and suitable mediums.

Scunbling is mostly practised in the lights as glazing is generally confined to the shadows. It is the opposite to glazing, for in scumbling the colour is used nearly dry, and applied stiff, with brushes sparingly charged, and partaking somewhat of the colour over which it is to be laid.

Scumbling renders the parts to which it is applied either light, grey, cool, less defined, or gives air and distance; it destroys the hardness resulting from over minuteness in details, lowers the briliancy, and unites opposing colours. The judicious use of scumbling and glazing in the same picture will produce harmony and richness, and if either has been used improperly, the one will be found to be the corrective of the other.

Impasting or Loading applies strictly to the lights and foregrounds, for as the colours in the shadows should always be thin, so those in the

lights should be thick and laid on with a full brush, especially in the more brilliant parts; yet in this there is a limit—a bad effect would be produced if the colours stood in ridges. This method may be successfully applied in painting branches and trunks of trees, the foremost leaves which catch the light, the foam of the water, the moss on rocks, and other like parts, as it will add depth and contrast to the shadows.

Oiling Out.—When the surface of an unfinished painting becomes dry, it is frequently difficult to commence upon it again. To obviate this, the painting should be carefully rubbed with a damp soft sponge, and wiped dry. Then a small quantity of nut or poppy oil should be applied with a brush, and afterwards cleaned off with a dry silk handkerchief. The oiling out has the effect of making the after painting unite with that done previously, and gives the work an appearance of being executed at the same time.

Handling or manipulation consists in the mechanical use of the brush. In it the individuality of the artist asserts itself, it is only acquired by constant practice and a study of the works of the leading masters. For instance, contrast Raffaele with Rubens, Teniers with Gerhard Douw, or Leighton with Watts, and it will easily be seen how each sought to interpret Nature in his own peculiar way.

INDEX.

BY THE SAME AUTHOR.

A HANDBOOK

OF THE

CHEMICAL & ARTISTIC QUALITIES

OF

WATER-COLOUR PIGMENTS.

Containing an analysis of the Report made to the Science and Art Departments by Messrs. Abney & Russell, on the action of Light on Water-Colours.

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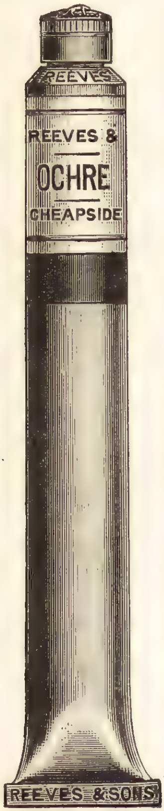
Radiant Yellow.	Perm. Crimson.	Cobalt Blue.
Yellow Ochre.	Burnt Sienna.	Viridian.
Raw Sienna.	Burnt Umber.	



4-INCH TUBE.

REDS.

	s.	d.
**Burnt Carmine . . .	1	6
**Burnt Lake	0	6
Burnt Roman Ochre .	0	4
Burnt Ochre	0	4
Burnt Sienna . . .	0	4
**Carmine	1	6
**Crimson Lake . . .	0	4
**Geranium Lake . . .	0	6
**Indian Lake	0	4
Indian Red	0	4
Light Red	0	4
**Madder Carmine . .	1	6
** Do. Lake	1	0
**Permanent Crimson .	0	6
**Pink Madder . . .	1	0
**Rose Madder . . .	1	0
**Rubens' Madder . .	0	6
**Scarlet Lake	0	4
Venetian Red . . .	0	4
**Vermilion	0	6
** Do. Chinese . .	0	6
** Do. Orange . .	1	0
** Do. Scarlet . .	0	9

PURPLES.

	s.	d.
*Magenta (aniline) . .	0	4
*Mauve (aniline) . .	0	4
**Permanent Mauve . .	1	0
**Purple Lake . . .	0	4
** Do. Madder . . .	1	0
**Violet Carmine . . .	1	6

YELLOWS.

	s.	d.
**Aureolin	1	6
**Cadmium, pale . . .	1	6
** Do. middle . .	1	6
** Do. deep . .	1	6
Chrome Yellow, pale .	0	4
Do. do. middle	0	4
Do. do. deep .	0	4
Do. Orange . . .	0	4
**Gamboge	0	4
**Indian Yellow . . .	1	0
*Italian Pink	0	4
*King's Yellow . . .	0	4
**Lemon do. . . .	1	0
**Mars Orange . . .	1	0
** Do. Yellow . . .	1	0
*Naples do., No. 1 . .	0	4
* Do. do., ,, 2. .	0	4
Orpiment	0	4
**Pure Orange . . .	1	0
**Radiant Yellow . .	1	6
Raw Sienna	0	4
Roman Ochre . . .	0	4
**Strontian Yellow . .	1	0
*Yellow Lake . . .	0	4
** Do. Madder . . .	1	0
Do. Ochre . . .	0	4

* These Colours are made in 3-inch Tubes.
** ,, ,, ,, 2 ,, ,,

SUPERFINE OIL COLOURS—continued.

BROWNS.	s.	d.
Asphaltum	0	4
Bitumen	0	4
Bone Brown	0	4
**Brown Madder ...	0	6
Brown Ochre... ...	0	4
*Brown Pink	0	4
Burnt Umber... ..	0	4
Caledonian Brown ...	0	4
*Cappah Brown ...	0	4
Cassel Earth	0	4
Cologne Earth ...	0	4
**Mars Brown	1	0
Mummy	0	4
Raw Umber	0	4
**Sepia	0	6
Vandyke Brown ..	0	4
Verona Brown ...	0	4

BLUES.	s.	d.
Antwerp Blue ...	0	4
Chinese Blue	0	4
**Cobalt Blue	1	0
**Coëlin (Cerulean) ...	0	6
**French Ultramarine ...	1	0
**French Blue	0	4
*Indigo	0	4
*New Blue	0	4
*Permanent Blue ...	0	4
Prussian Blue ...	0	4
**Smalt	6	0
**Ultramarine (genuine)	21	0
** Do. (second)	10	6
**Ultramarine Ash ...	2	6

BLACKS.	s.	d.
Blue Black	0	4
Black Lead	0	4
Ivory Black	0	4
Lamp Black	0	4

GREENS.	s.	d.
Chrome Green, pale ...	0	4
Do. do. middle	0	4
Do. do. deep...	0	4
**Cobalt Green... ...	1	0
Emerald Green ...	0	4
**Green Oxide of Chromium	1	0
** Do. transparent ...	1	0
**Malachite Green ...	1	0
*Olive Green	0	4
*Sap Green	0	4
Terre Verte	0	4
**Verdigris	0	4
**Viridian (Veronese) ...	1	0

WHITES.	s.	d.
Cremnitz White ...	0	4
Flake White	0	4
Permanent White ...	0	4
Silver White	0	4
Zinc White	0	4

GREYS.	s.	d.
**Charcoal Grey ...	0	4
**Mineral Grey... ...	1	0
*Neutral Tint	0	4
*Payne's Grey... ...	0	4

MEDIUMS.	s.	d.
Copal Megilp... ...	0	4
Megilp	0	4
Siccatif	0	4
Sugar of Lead ...	0	4
Medium (Reeves') ...	0	4

* These Colours are made in 3 inch Tubes.
** " " " 2 " "

Double Tubes at double the above Prices.

Flake White, ¼ lb. tube, 1/0; ½ lb. tube, 1/3; 1 lb. tube, 2/6.
Foundation White, in double tubes, 0/4.
Medium (Reeves') double tubes, 0/8; treble tubes, 1/0.

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		1 oz. Bottles.	2 oz. Bottles.	¼ Pint Stone Bottles.	½ Pint Stone Bottles.	1 Pint Stone Bottles.
Varnishes.	Amber Varnish	1/0	2/0	3/9	7/0	13/6
	Crystal Varnish	0/5	0/9	1/3	2/3	4/6
	Mastic Varnish	0/9	1/6	3/0	5/6	10/0
	Copal Oil Varnish	0/6	1/0	1/8	3/0	6/0
	Picture Copal Varnish	0 6	1/0	1/8	3/0	6/0
	White Copal Spirit Varnish ...	0/6	1/0	1/8	3/0	6/0
	White Lac Varnish	0/6	1/0	1/8	3/0	6/0
Oils.	Nut Oil	0/3	0/6	0/11	1/6	3/0
	Poppy Oil	0/3	0/6	0/11	1/6	3/0
	Purified Linseed Oil	0/3	0/6	0/8	1/0	1/9
	Pale Drying Oil	0/3	0/6	0/9	1/3	2/3
	Special Pale Drying Oil	0/4	0/8	1/0	1/9	3/6
	Strong Drying Oil	0/3	0/6	0/9	1/3	2/3
	Japan Gold Size	0/4	0/8	1/0	1/9	3/6
	Spirits of Turpentine	0/3	0/5	0/7	1/0	1/6

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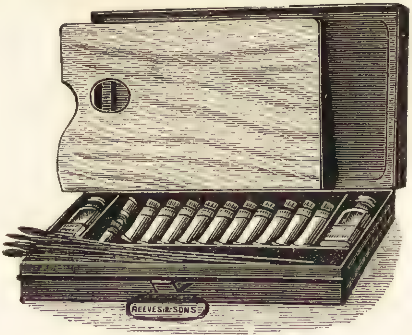
Size, 8 in. by 4⅜ in., by 1¼ in. deep, with Corrugated Platform for the Tubes to rest upon, Sunken Well in lid to protect wet Palette, containing 14 Finest Oil Colours, 6 Brushes, Wooden Palette, Bottle of Pale Drying Oil and Dipper . . . . Price, complete	0	7	6

Price, empty, 2*s.* 3*d.*

THE HALF GUINEA POCKET BOX.



Size, 9⅜ in. by 5½ in., by 1⅜ in. deep, with Corrugated Platform for the Tubes to rest upon, Sunken Well in lid to protect wet Palette, containing 12 Finest Oil Colours, 6 Brushes, Wooden Palette, Bottles of Pale Drying Oil and Turpentine . . . . . . Price, complete	0	10	6

Price, empty, 4*s.*

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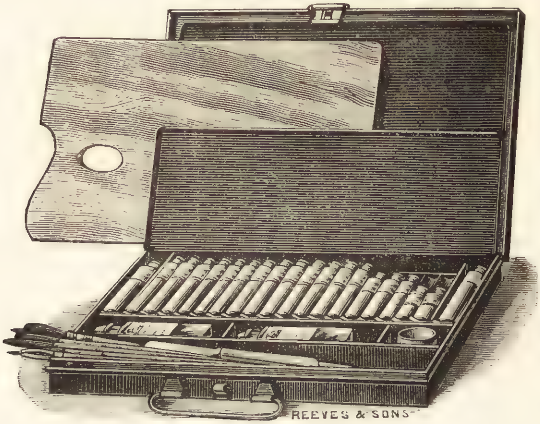
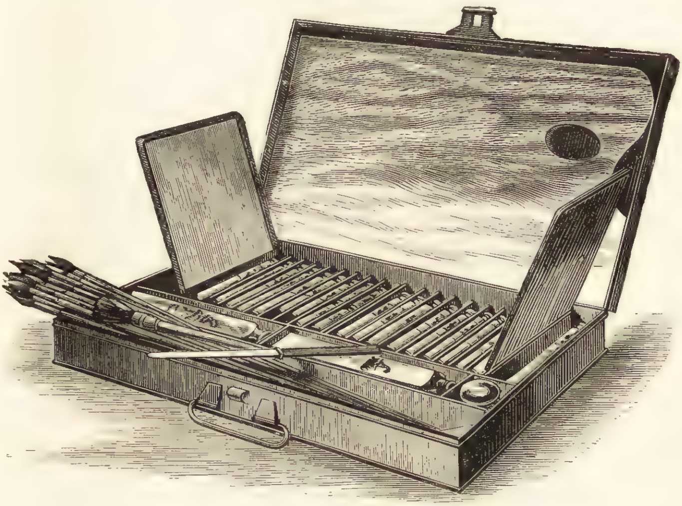
No.		£ s.
1500A	**Sketching Box,** size 10½ in. by 6 in., 1¼ in. deep, containing 13 Tubes of Finest Oil Colours, Bottles of Drying Oil and Turpentine, Sable and Hog Hair Brushes, Palette Knife, Dipper, and Wooden Palette . . . Price, complete Price, empty, 5*s.*	0 15
1500B	**Sketching Box,** size 12¼ in. by 6 in., 1¼ in. deep, containing 15 Single and 1 Double Tubes of Finest Oil Colours, Bottles of Drying Oil and Turpentine, Sable and Hog Hair Brushes, Palette Knife, Dipper, and Wooden Palette Price, complete Price, empty, 6*s.*	1 1



		£ s.
1504	**Sketching Box,** size 12¾ in. by 8½ in., 1½ in. deep, containing 21 Finest Oil Colours (19 Single and 2 Double Tubes), Bottles of Turpentine and Pale Drying Oil, Sable and Hog Hair Brushes, Badger Hair Softener, Palette Knife, Chalk, Port-crayon, Dipper, and Wooden Palette . . Price, complete Price, empty, 7*s.* 6*d.*	1 10
1504D	The same size and fittings as No. 1504, with the addition of a double bottom for Millboards, and containing 2 Prepared Millboards, 12 in. by 8 in. . . . . Price, complete Price, empty, 11*s.* 3*d.*	1 15

apanned Tin Boxes of Finest Oil Colours—*continued.*



No.		£	s.	d.
1505	**Complete Sketching Box,** with flap over the colours, size, $12\frac{3}{4}$ in. by $8\frac{1}{2}$ in., $1\frac{1}{2}$ in. deep, containing 23 Finest Oil Colours (21 Single and 2 Double Tubes), Bottles of Turpentine and Pale Drying Oil, Sable and Hog Hair Brushes, Badger Hair Softener, Palette Knife, Chalk, Port-crayon, Dipper, and Wooden Palette. Price, complete	2	0	0
	Price, empty, 10*s.*			
1505D	The same size and fittings as No. 1505, with the addition of a double bottom for Millboards, and containing 2 Prepared Millboards, 12 in. by 8 in. Price, complete	2	5	0
	Price, empty, 14*s.*			

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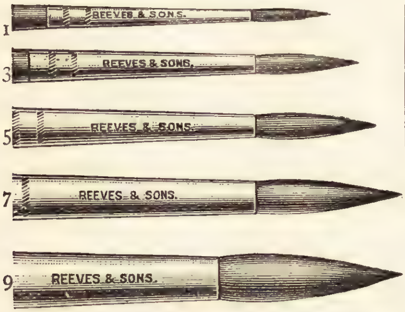
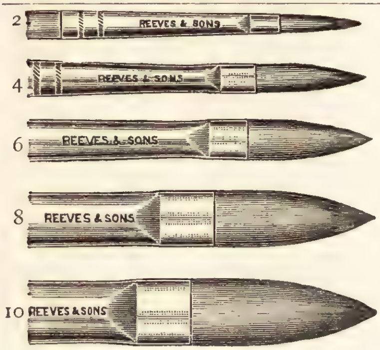


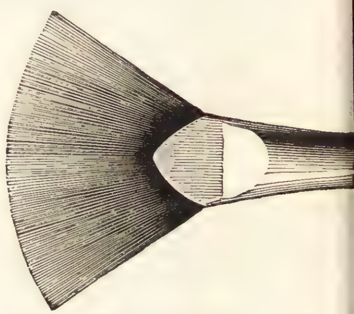
ROUND.

BRIGHTS (Short and Square).

RIGGER (Extra Long).



FLAT.

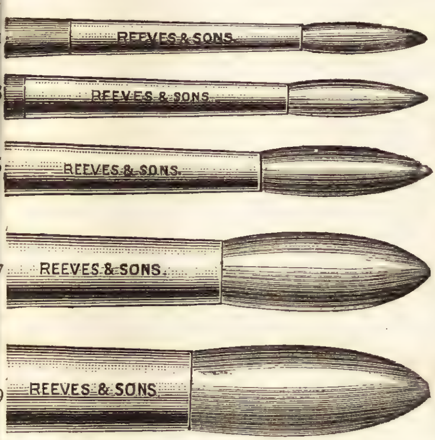


FAN SHAPE.

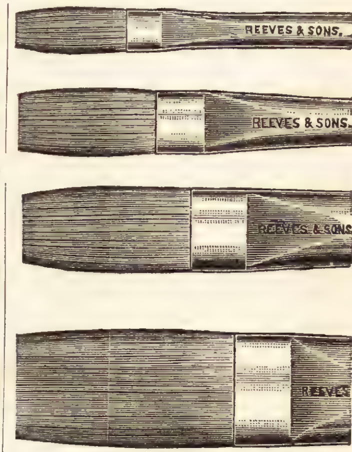
Sizes—	0	1	2	3	4	5	6	7	8	9	10	11	1
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s.
Flat ...	0 6	0 6	0 7	0 8	0 11	1 2	1 3	1 6	2 2	2 8	3 2	3 9	4
Round ...	0 6	0 6	0 7	0 8	0 11	1 2	1 3	1 9	2 6	3 2	3 9	4 6	5
Brights ...	0 6	0 6	0 7	0 8	0 11	1 2	1 3	1 9	2 6	3 2	—	—	—
Riggers ...	0 6	0 6	0 8	0 9	1 0	1 3	1 6	—	—	—	—	—	—
Fan ...	—	0 8	0 9	0 11	1 3	1 6	1 9	—	—	—	—	—	—

FINEST HOG HAIR BRUSHES.

1
3
5
7
9



ROUND.



2
4
6
8

FLAT.

SIZES—	0–6	7	8	9	10	11	12
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
A, round or flat, finest Lyons hair	0 6	0 8	0 10	0 11	1 1	1 3	1 6
B, ,, ,, fine ,, ,, ...	0 4	0 5	0 6	0 7	0 8	0 9	0 10
C, ,, ,, finest French ,, ...	0 3	0 5	0 6	0 7	0 8	0 9	0 10
E, ,, ,, fine ,, ,, ...	0 2	0 4	0 5	0 6	0 6	0 7	0 8

2

F

3

G

SIZES—	0–6	7	8	9	10	11	12
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
F, flat, short, and thin, fine French hair ...	0 2	0 4	0 5	0 6	0 6	0 7	0 8
G, ,, ,, ,, very thin, fine Lyons hair	0 3	0 4	0 5	0 6	0 6	0 7	0 8

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